THE IRON TRADE REVIEW

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Brisk Buying at Low Prices

Large Tonnage Placed With Buffalo Furnaces—Buying of Machinery and War Materials by Allies Continues

Sales of pig iron in the Buffalo district during the past few days have amounted to about 200,000 tons, for delivery during the last six months of the year. This is the only important buying movement since last November, when about the same tonnage was placed, but it differs from the November movement in being made up of a very large number of orders. Some of the more important buyers were able to place their orders at as low as $11.50, furnace, for No. 2, but it is believed that the greater part of the tonnage was placed at $11.75 to $12. As the prevailing price recently has been considerably higher, and was $13 in February, sellers had hoped that the market for the last half of the year would not be less than $13. Hence the opening for last half delivery at low prices is not expected to have a favorable effect on the general situation. It is not believed, however, that sellers in other districts will be quick to follow the policy of Buffalo furnaces. Sales have been made at $13, furnace, in the Cleveland district, and some southern furnaces are refusing to shade $9.50. The recent sales by Buffalo furnaces were largely for delivery at distant points, especially in New England.

Plates and Shapes

Owing to the advance in prices of plates in England, eastern mills have been able to make some sales for export to that country. In the central west, the plate market is weak, and 1.10c, Pittsburgh, is freely done on desirable business. Structural material prices are also weak and new contracts are not numerous. Renewal of subway work in New York City will call for a considerable tonnage. Much uncertainty still surrounds the sheet mill situation, but the outlook seems to be favorable for the men accepting the proposed reduction in wages.

Machinery

The foreign demand for lathes continues and almost the only question involved in the placing of the business is that of time of delivery. The Bethlehem Steel Co., in addition to inquiring for 300 lathes, as heretofore reported, is figuring on buying a large number of other machine tools. Some manufacturers of planers and shapers have abandoned temporarily the manufacture of their products and are making milling machines and parts for lathes. This is especially true in Cincinnati.

Corporation Activities

The Corporation continues to operate at about 70 per cent of ingot capacity. Its new business and shipments are about equal and the unfilled tonnage for March will probably show little change. Its foreign business last week was the best since war was declared.

Railroad Buying

The Steel Corporation has sold 12,000 tons of rails for shipment to the far east and 5,000 tons for Greece. The Great Northern has closed for 2,000 additional tons with the Illinois Steel Co., while 8,500 tons previously reported for the Northern Pacific have been formally entered. The Lakewood Engineering Co., Lakewood, O., has taken an order from the French government for 30 miles of portable track.

Bars

Considerable strength has been added to the steel bar market by heavy inquiries for rounds for the manufacture of shrapnel for the allies and the market is firm at 1.15c, Pittsburgh.

THE OPEN HEARTH

Some Points of the Report

THE report of the United States Steel Corporation for 1914, the worst year in its history, is notable for the brevity of its comment on the distressing conditions which prevailed throughout the 12 months. Probably Judge Gary was of the opinion that the figures spoke for themselves and needed no comment and that any attempt to explain the causes for the depression would do no good. So he adheres to the policy, which prevailed to a greater extent a few years ago than in recent years, of merely stating facts. Only incidently is the depression of 1914 referred to, as, for example, in connection with the explanation of the decision not to offer employes the usual annual privilege of subscribing for stock under the plan which has been adhered to for 12 years. The reason given for this decision is found in the "disturbed and uncertain conditions of the steel industry prevailing at the close of the year, the large number of employes who at that time were laid off because of mills being shut down or running only on part time, and also because of stock market conditions".

The statistics as to employes and wages show that the Corporation has done all in its power to maintain wages and to keep on its payrolls as many men as possible. It is true that the number of employes shows a decrease of 21.65 per cent and that the payrolls decreased 21.63 per cent, but the decrease in payroll and number of employes is less in almost every instance than the decrease in percentage of various products turned out. The decrease in production of leading products was as follows: Iron ore, 40.72; coal, 31.26; coke, 32.94; limestone, 26.22; pig iron, 28.61; steel ingots, 29; finished steel products, 27.15; Portland cement, 18.59. In the case of materials used principally by railroads and in heavy construction and important development work, the decreases were as follows: Steel rails, 49.2; angle bars and rail joints, 49.4; plates, 37.8; heavy structural shapes, 38.5. The average salary of all employes, including general administrative and selling force, shows an increase of 5 cents per day, the figures being $2.97 for 1914 and $2.92 for 1913, as the general advance made in 1913 did not take effect until Feb. 1, of that year.

That the deficit of the Steel Corporation was not much more than $17,000,000 is due to the rigid economies which were put into effect, especially in capital expenditures for the acquisition of additional property and for additions and extensions less credits for property sold, which amounted to $41,999,098 in 1913 and only $23,171,013 in 1914, a difference of $18,828,085.

While no attempt is made to paint a rosy picture of the future, some encouraging statements are recorded, as, for example, the report says that following the declaration of war in Europe the decrease in export business was relatively greater than in domestic trade, but since Jan. 1, there has been a material development in export business, which at present is equal to the average of the last three years. Hope is expressed that business conditions may warrant the completion of the new steel plant at Duluth during the present year. It is stated that of the 4,345,371 tons of unfilled orders on March 1, 1915, a considerable percentage covers contract requirements extending through the first six months of 1915. We believe, however, that this language was not intended to mean that a large part of the tonnage was placed in accordance with the old-fashioned blanket contract for requirements. For some time past, the Steel Corporation, in selling structural steel, has positively refused to make what have been known as requirement contracts, but has given protection against definite jobs with the distinct understanding that if the price should recede before the delivery of all the product contracted for, the contract price would not be reduced. In this way, much of the business of the Corporation has been placed on a more satisfactory basis than in past years. It should also be noted that contracts for steel bars and other materials are not made for as long periods as in past years.

Unfavorable as the report is from a financial standpoint, there is abundant reason for encouragement in the fact that, in spite of conditions which are not only unprecedented and, so far as any man can conceive, will never occur again, this mighty business organization has

THE OPEN HEARTH

been able, through its magnificent management, to make a showing which is in many ways very creditable.

Not a Party Organ

LIBERAL extracts of the story recently published by *The Iron Trade Review* of unjust, unfair and unpatriotic discrimination against American labor and industry in the purchase of cranes for the Panama canal are re-published by the *American Economist,* which then adds:

There is one more chapter to this miserable story of preference for foreigners merely on account of supposed "cheapness," that we add with a sense of shame. That is the fact that the acceptance of the German low bid occurred under an administration that stood pledged to show a preference for American labor and industry. If the Wilson free-trade administration had gone abroad to purchase government supplies because they could be had at lower prices it would be taken as quite in harmony with the free-trade doctrine of buying in the cheapest market, and would have caused no surprise. But it was a Republican and (supposedly) a protectionist administration that sent American money abroad to pay for machinery which could as well—indeed, very much better, as events proved—be made by American labor. The episode serves to once more emphasize the conclusion that the administration of William Howard Taft was anything but a protectionist administration.

The Iron Trade Review is not an organ of the Republican party, or any party. It is trying to advocate a broad American policy and intends to criticize any party or any official whose conduct is not in harmony with that kind of a policy. We are not particularly interested as to whether the administration of William Howard Taft was or was not a protectionist administration. We are looking to the future, in the hope that the country will demand that the next administration shall be pledged to a reasonable policy of protection.

To further illustrate our ideas as to how American industries should be protected, we may refer to the benzol industry which is being rapidly developed in the United States. Thomas A. Edison has been quoted as saying that this country allows twenty million gallons of benzol to escape into the air in gas from coal in the manufacture of coke, every year, and that in going into the manufacture of benzol he is gambling on the war, because he believes that when the fighting is over, the Germans will resume the manufacture of benzol and sell it in this country at a lower price than it can be made in the United States. He says he expects to get his money back before the war is ended. Now it strikes us that there ought not to be any gamble about a product of this kind, provided Americans are willing to make benzol and sell it at a reasonable price. They ought to be given protection, so that when the war ends, the manufacture can be continued in this country. A fair minded and intelligent tariff commission would, we are confident, recommend protection.

Patent Reforms Go Through

IN AN article on the patent situation, entitled "A Big Handicap to Industry", published in *The Iron Trade Review* of March 18, it was pointed out how an important bill designed to improve conditions in the patent office failed of passage in the last congress because a page neglected to deliver it to the engrossing clerk. Inasmuch as it was not engrossed, the measure, of course, did not reach the President and never became a law, although strongly favored by both branches of congress as well as by the patent office.

It is now stated on the authority of Senator James that even though the bill was mysteriously lost, there will be no delay in the actual reorganization of the patent office. Secretary Lane, of the department of the interior, said Mr. James, realizes that the measure was adopted by the house and senate and has the endorsement of the President; he, therefore, will make up his annual estimates in accordance with the provisions of the missing bill.

This is a matter for congratulation as far as the patent office is concerned. The incident, however, reflects no glory on officials at Washington. It adds one more item of evidence to the charge that government business has no parallel for inefficiency. Why should the enactment of an important bill depend on the whims of a boy?

Prices Present and Past

Quotations on leading products today, average for last month, average for three months ago and average for March 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Today's prices.	Average for Feb., 1915.	Average for Dec., 1914.	Average for Mch., 1914.
Bessemer pig iron, Pittsburgh..	$14.55	$14.63	$14.70	$15.15
Basic pig iron, Pittsburgh.....	13.45	13.45	13.45	13.96
No. 2 Fdy. pig iron, Pittsburgh	13.80	13.70	13.70	14.09
Northern No. 2 Fdy., Chgo....	13.00	13.00	13.00	14.25
Lake Superior Charcoal, Chgo..	15.75	15.75	15.75	15.50
Malleable, Bessemer, Chgo.....	13.00	13.00	13.00	14.25
Southern No. 2, Birmingham...	9.25	9.50	9.50	10.50
Southern Ohio No. 2, Ironton..	12.75	12.75	12.63	13.00
Basic, eastern Pa.....	14.00	14.00	13.50	14.25
No. 2X Virginia furnace.....	12.50	12.50	12.50	12.75
No. 2X Foundry, Philadelphia..	14.50	14.25	14.25	15.00
Ferro mang. Balti. (prompt)...	100.00	100.00	68.00*	38.00
Billets, Pbgh.....	20.00	19.50	18.50	21.00
Sheet bars, Pbgh.....	20.50	20.00	19.00	22.00
Steel bars, Chicago.....	1.34	1.045	0.95	1.17
Steel bars, Pittsburgh.....	1.15	1.10	1.10	1.20
Iron bars, Philadelphia.....	1.125	1.12	1.12	1.27
Iron bars, Cleveland, local del'y.	1.25	1.15	1.15	1.25
Iron bars, Chgo. mill.....	1.15	1.31	1.20	1.38

*Nominal

	Today's prices.	Average for Feb., 1915.	Average for Dec., 1914.	Average for Mch., 1914.
Beams, Chicago	$1.34	$1.31	$1.20	$1.43
Beams, Pittsburgh	1.15	1.10	1.11	1.20
Beams, Philadelphia.....	1.259	1.25	1.20	1.30
Tank plates, Pittsburgh.....	1.15	1.10	1.09	1.20
Tank plates, Chicago.....	1.34	1.28	1.25	1.38
Tank plates, Philadelphia.....	1.259	1.25	1.20	1.30
Sheets, blk., No. 28, Pittsburgh	1.80	1.80	1.80	1.95
Sheets, blue an., No. 10, Pbgh..	1.30	1.30	1.30	1.40
Sheets, galv., No. 28, Pbgh.....	3.40	3.01	2.80	2.95
Wire nails, Pittsburgh.....	1.60	1.55	1.50	1.59
Connellsville fur. coke contr....	1.65	1.65	1.70	2.00
Connellsville fdy. coke, contr....	2.25	2.25	2.25	2.50
Heavy melting steel, Pbgh.....	12.00	11.55	10.06	12.37
Heavy melting steel, east'n Pa.	11.25	10.50	9.50	11.50
Heavy melting steel, Chgo.....	9.75	9.44	8.25	9.81
No. 1 wrought eastern Pa.....	12.00	12.00	11.50	14.00
No. 1 wrought, Chgo.....	9.00	8.81	7.50	9.00
Rerolling rails, Chgo.....	10.00	9.50	9.50	11.19
Car wheels, Chgo.....	10.00	10.00	10.00	11.75

(For Additional Prices See Page 642.)

Buffalo Sellers Make Big Drive

And Book Large Number of Orders, Aggregating About 200,000 Tons—Low Prices Made—Market in Other Centers Dull

Buffalo, March 23.—A buying movement started late last week in New England and Atlantic coast states supplied by furnaces of the Buffalo district, following the break in the market, resulted in the booking of 150,000 to 200,000 tons of pig iron by the producing interests of this section, some going as low as $11.50, but most of it at $11.75 and $12.

Buffalo foundry interests did not participate in the buying to any great extent, but a number of the local melters are figuring on covering for their requirements over the second, third and last quarter of the year if the present level of prices prevails.

Grade differentials have been practically wiped out for the time being. A liberal tonnage of No. 2X foundry was booked by the Buffalo district stacks at $12. Over 100 eastern buyers figured in the movement, placing their contracts for lots of 500 to 1,000 tons and upwards for deliveries extending over the remainder of the year.

The furnaces of the district continue to book orders for small tonnage at prices somewhat higher than the figures reached in the heavier buying movement, which developed a greater degree of activity on the part of the selling interests than has been noticed in this district in a long time. One of the smaller producing interests alone booked 40,000 tons in the first two days of the buying movement.

There are at present 10 of the 12 merchant stacks of the district, including the one at Charlotte, in blast, producing upwards of 3,000 tons of iron per day, or 90,000 to 100,000 tons per month, showing that the heavy sales of the week can be filled in the course of less than two months by these furnaces, to say nothing of the iron piled on furnace yards.

One melting interest of the city received direct advice from Pittsburgh that English buyers had placed an order for 100,000 tons of pig iron with Pittsburgh producers and that the arrival of the money, now en route, is all that remains to consummate the deal. It is understood that other orders from the same source are expected. The heavy buying in Buffalo plus the reported Pittsburgh booking, it is figured, will have a tendency to cause pig iron prices to become firmer.

Large Tonnages Quickly Bought

New York, March 23.—A spectacular break in Buffalo prices to $12 and lower at furnace for No. 2X or malleable for last half shipment in connection with a sweeping selling drive in New England, New York State, New Jersey and other eastern districts, has resulted in heavy bookings by these producers during the past few days. This selling movement was conducted quietly though swiftly, covering only a few days and full information regarding buyers and tonnage is coming out slowly, but it is estimated that the sales easily totaled 150,000 tons and may have overtopped 200,000 tons. These figures appear conservative rather than excessive, in view of the extent of similar drives on previous occasions and of the size of some of the known sales. Some of the amounts understood to have been placed are about 10,000, including 6,000 tons of high phosphorus and 4,000 tons of medium phosphorus iron to a Whitinville, Mass., buyer; 5,000 to 6,000 tons of foundry to a Dover, N. J., stove maker; 2,500 tons to a Hartford, Conn., shop; 1,000 tons to a Hyde Park, Mass., consumer, and large lots to Westfield, Mass.; Hopedale, Mass., and other leading New England, New Jersey and New York State buyers. The Delaware, Lackawanna & Western railroad tomorrow will distribute with Buffalo makers, 4,000 tons of forge and No. 2X for shipment over the rest of the year. The sales also extended to Philadelphia, Baltimore and other distant points. At $12, Buffalo, for No. 2X or malle-

(*For complete prices see page 642.*)

able, the prices quoted have been $14.58, New England, Philadelphia or Baltimore, and $13.84 to $14.10, at leading northern New Jersey destinations near tidewater. Eastern Pennsylvania, central Pennsylvania and other nearby makers, have been unwilling to meet the Buffalo competition, though some of them have taken orders this week at $14.25 for No. 2X in the tidewater zone. The effect of the Buffalo aggressiveness has been to stir up more last half inquiry generally and a number of lots now are pending, some of them quietly. An Elizabeth buyer took 600 tons and a Jersey City consumer is about to place 2,000 tons. A Newark buyer who recently took 2,000 to 3,000 tons is figuring on 2,000 tons more. Other 500 to 1,000-ton negotiations are current. Virginia makers have booked 1,000 to 2,000 tons more for last half at $12.50, furnace, principally in New England.

Low Prices at Buffalo

Philadelphia, March 23.—The week has witnessed the inauguration of offers to sell Buffalo iron for last half at $12, furnace, or $14.58, Philadelphia. Otherwise, only small currents of change have taken place. The effect in this vicinity of the weakening of the Buffalo market is problematical. The delivered price is about on a par with what most eastern Pennsylvania and surrounding producers have been quoting and is not as low as some of them have been doing. It is likely, however, that any aggressive move by Buffalo furnaces in eastern Pennsylvania will tend to bring about more last half buying generally, which as yet has been unconsequential. Virginia makers continue to take on some third quarter and last half orders at $12.50, furnace, for No. 2X and at $12.25, furnace, for No. 2 plain. The Pennsylvania railroad, which was inquiring for 2,100 to 4,200 tons of several foundry grades for second quarter for Altoona has closed for the maximum quantity, the business going to western and central Pennsylvania makers. It also took 1,000 tons of Lake Superior charcoal and 500 tons of a New England charcoal brand. It is understood that the local locomotive builder has been a recent buyer of some tonnage of foundry from a western Pennsylvania producer. Some small sales of Alabama iron for shipment by July 1 have been made in this district at $9.50, Birmingham. A Lynchburg, Va., pipe maker is inquiring for 1,000 tons of mottled. This grade can be bought at $8.25, Birmingham. Some reports persist that the United States Cast Iron Pipe & Foundry Co. is about to make some additional purchases of southern metal. Steel making irons remain very slow. The Cumberland, Md., buyer has asked for 500 tons of prompt basic. There is no interest in this grade among eastern Pennsylvania consumers and the price nominally is $14, delivered. Low phosphorus sales are small. Some further trial lots of a few tons each have been sold for shipment to the British Isles. Low phosphorus prices are unchanged. One of the Crane furnaces at Catasauqua, which has been banked for some weeks, is slated to resume shortly.

Buffalo News Depressing

Cleveland, March 23.—Sales of 2,000 tons of No. 2 foundry for last half delivery at $13, furnace, indicated that buying would be started in this district at fair prices, but the news from the Buffalo district of large sales at less than $12, furnace, is expected to have a tendency to halt buying in this section until conditions develop more fully. The effect of the Buffalo transactions is depressing.

Quiet Inquiry Reported

Pittsburgh, March 23.—Quiet inquiry for basic pig iron is reported by several dealers in western Pennsylvania, but the open market continues rather dull and inactive. The Pennsylvania railroad has bought about 4,000 tons of foundry iron from central and western Pennsylvania stacks, and 1,500 tons of charcoal iron from Lake Superior and New England furnaces for its Altoona, Pa., shops. No other sales of importance are reported. Shipments of steel-making grades show a moderate increase and foundry shipments have not fallen off this month. Mattie furnace of the Girard Iron Co., Girard, O., and Perry furnace of the Perry Iron Co., Erie, Pa., are ready for the torch.

Market is Marking Time

Chicago, March 23.—Unusual in activity is evident in the pig iron market and melters apparently are waiting until business in general reveals itself more clearly before obligating themselves for further tonnage of pig iron. The inquiry which was evident early in the present month for iron to be delivered during last half has not persisted and after refusal of many makers to quote for that delivery, the effort seems to have subsided. A small tonnage has been contracted for last half on the basis of $13.50, Chicago, for No. 2 foundry, but this is not of sufficient volume to be significant.

Salesmen find a peculiar situation among foundries in that some are exceedingly busy, while others have practically no business before them. The causes which produce this position are obscure and do not appear on the surface. With practically all local furnace companies operating only a single stack, where ordinarily two or more would be in blast, it is becoming increasingly difficult to provide the several grades of iron demanded by the trade and in some cases delayed delivery results when one grade is ordered, while the furnace may have an excess of the other grades which will not fill requirements. Furnace books have some rush orders and some requests for anticipated shipments, while at the same time other melters are requesting that their iron be held.

With practically no business being figured on and buying at a low ebb, quotations on northern No. 2 foundry and malleable are nominally $13, Chicago furnace, with no evidences of shading.

Southern iron is equally sluggish in this market, with $9.50, Birmingham, as the prevailing quotation and some sellers asking $9.75, Birmingham, for second half delivery. Some slight tonnages have been placed for the latter half of the year at this rate, but, like northern iron for the same period, the total sales are not considerable.

Silvery Iron Reduced

Cincinnati, March 23.—The pig iron market is void of large transactions, and even sales of carload lots are widely scattered. A redeeming feature is that shipments on old contracts are going forward in a very satisfactory manner, and that stocks in yards are not increasing. Silvery iron has been reduced from 25 to 50 cents a ton, and is now quoted at from $14.75 to $15.25, furnace. A considerable tonnage of this grade has been sold in this and adjoining territories recently, and through competitive bidding the lower prices were made evident. A small amount of Tennessee iron is still available below $9.50, Birmingham basis, for No. 2 foundry, providing prompt payments can be made, as the receiver of one furnace in that state is anxious to secure ready cash at once, and will make a few sacrifices to do so. Other makers in both Alabama and Tennessee are holding firmly at from $9.50 to $9.75, Birmingham, for this grade, for the first half, and some will sell for the second half at the same figures. Southern Ohio furnaces are refusing attractive business which is being offered them daily below $12.75, Ironton basis, for No. 2 foundry, and one stack in the Hanging Rock district will not sell below $13, Ironton, for this grade.

(*For complete prices see page 642.*)

New Bar Price Holds

And Some Sales Have Been Made for April Delivery at 1.20c —Bar Iron Not So Active at Chicago

New York, March 23.—A Brooklyn manufacturer, who recently placed 10,000 to 11,000 tons of 3⅜ and 5½-inch steel rounds to be used in the manufacture of shrapnel with the Cambria Steel Co. also has ordered 6,000 tons of these bars from the Crucible Steel Co. of America and 6,000 tons from the Carbon Steel Co., bringing the total of its last purchases to about 22,000 tons. The total quantity of such bars bought in recent months by this company approximates about 30,000 tons. Various negotiations for bars for shrapnel continue under way and some of these call for very large amounts. The French government is in the market for some especially large tonnages which one statement makes to be more than 100,000 tons. The English government has placed a contract for 12,000 lydite shells and is negotiating for shrapnel. An inquiry for 1,000 tons of 3⅜-inch rounds for a New Jersey company has been withdrawn, but this plant remains a prospective buyer of similar material for another contract. The prices which shrapnel bars recently have sold have been around 2.25c, tidewater. The Turner Construction Co. has taken the general contract for large terminal warehouses at Hoboken, which will require a considerable tonnage of reinforcing bars. Not much tonnage is involved in new business for other than war contracts. Such business as is going, however, indicates that 1.309c, New York, or 1.15c, Pittsburgh, is being well maintained.

New Bar Price Holds

Philadelphia, March 23.—As far as can be determined by the small sales moving, steel bar prices for March are holding firmly at 1.309c, Philadelphia or 1.15c, Pittsburgh. Further small but not unattractive lots have been sold at this figure. There still is talk among makers that the price for second quarter will further advance to 1.20c, Pittsburgh. Specifications against contracts are of moderate quantity. The Cumberland Valley railroad will shortly buy 250 to 300 tons of reinforcing bars as part of the requirements for its new concrete bridge at Harrisburg. More tonnage will be taken later. An inquiry for 500 to 1,000 tons of 3⅜-inch rounds for a Harrisburg buyer who has been figuring on additional shrapnel contracts with European countries has become inactive, as it is understood the business was placed elsewhere. This buyer is covered on its requirements of forged bars, under a shrapnel contract which it now is executing. Makers of shafting now are quoting 70 off at Pittsburgh on carloads and 65 off on less than carloads.

Bars Firm at Pittsburgh

Pittsburgh, March 23.—Demand for steel bars continues fairly satisfactory, some of the more important mills reporting that shipments this month are as heavy as those in the corresponding period of February. Steel bars seem firm at 1.15c for prompt shipment. The bar iron market is quiet and quotations are untested.

Steel Bars Are Quiet

Chicago, March 23.—Some sellers of steel bars find specifications are coming in increasing volume, although the gain from week to week is scarcely perceptible. Comparing a given period with a month preceding shows the advance and the rate of growth seems to be steady without offering any sensational increases. Other sellers find their market almost stationary and in some cases buying almost absent.

A determined effort is being made to maintain bars at 1.34c, Chicago mill, and experiences suffered late last year are assisting materially in preventing price cutting.

Hard steel bars are steady at 1.25c, Chicago mill, but demand is slackening and a producer on the Mississippi river is running its mill only part time.

Some Sales at 1.20c

Cleveland, March 23. — Cleveland companies which are figuring on contracts for shrapnel sent out inquiries for several thousand tons of rounds. It is probable that contracts will be made soon. The 1.15c, Pittsburgh, price on steel bars is firm. Bar iron is dull, with prices unchanged. Some sales of steel bars have been made for April delivery at 1.20c.

Bar Iron Demand Less

Chicago, March 23.—Although prices have not suffered, demand for iron bars is decidedly less in this market and mills are not operating as strongly as before the demand slackened. Quotations still are 1.15c, Chicago mill, and no evidence is found of lower prices being taken. One interest which has operated almost at capacity for many months is thinking of reducing its schedule and others which have lost more or less time are running on a reduced scale.

(For complete prices see page 642.)

Small Betterment in East

Philadelphia, March 23.—Some of the eastern Pennsylvania bar iron plants are running better, but it is understood this has been accomplished by some sacrifice of prices. Some makers report that for them the situation is unchanged and is poor. The mills are being offered some forward contracts, but usually they are backward about obligating themselves at the prices offered. The usual range of present prices for common bars is 1.10c to 1.15c, mill, but the inside figure has been shaded in several instances recently.

Specifications Better

Buffalo, March 23.—The demand for bar material under contract is reported better than it has been for several weeks. Specifications are coming in steadily. Prices are being held firmly at 1.15c, base, for delivery over the remainder of the quarter, with a price of 1.20c to go into effect on deliveries after April 1, for second quarter needs. A small aggregate of new business is reported by the mills and agencies of the district.

Reports from the central and eastern portion of the state indicate that a good many building undertakings in reinforced concrete are being figured, which will add materially to the demand for bars.

Hoops, Bands, Shafting

Pittsburgh, March 23.—While hoops are being held at a minimum of 1.25c by most makers, expressions are heard that an attractive inquiry would develop a slightly lower quotation. Bands are firm at 1.15c. Cold rolled shafting is being offered at a spread from 69 to 70 per cent off the list, and classification dated March 15, when the group or district plan was abolished and all districts are now based Pittsburgh, with freight added to all points. On screw stock sizes, or from ¼ inch to 47/64 inch inclusive, varying prices are now quoted, depending upon the size, whereas formerly these were quoted at a flat price for the group. The base on rounds is now from 2 inches to 3 inches inclusive, as against 1½ inch to 3 inches inclusive on the old list. Quantity differentials have also been added.

Sheet Mill Situation

Is Uncertain—Amalgamated Association Will Have a Third Referendum on Wage Reduction

Pittsburgh, March 23.—Sheet and tin mill divisions of the Amalgamated Asociation of Iron, Steel and Tin Mill Workers again will consider a revised wage scale, March 27, at a third referendum election. Proposed reductions, amounting to about 11.2 per cent for sheet mill and 6 per cent for tin plate mill men, twice have been rejected by big majorities. Sublodges were induced to reconsider new scales by representatives from the Mahoning valley, where operations have been irregular since the wage question first was considered six weeks ago. Mahoning valley lodges at the last election, March 13, voted to accept proposed cuts, and have since asked other lodges to consider a lower scale than that signed for the year expiring June 30, next. Sheet and tin plate mills controlled by the Amalgamated Association are either idle or operating at reduced schedules, awaiting developments. Other mills are enjoying fairly good activity. Demand for automobile sheets has been especially good, and deliveries are deferred in at least one instance. Galvanized steel sheets are held at 3.40c for base size gage, but that figure is not being uniformly quoted, as was the case a fortnight ago. Black and blue annealed sheets appear firm at current quotations.

Sheets Steady

Cincinnati, March 23.—Business is still of the hand-to-mouth character, as mills will only quote for prompt deliveries, and quotations are subject to change from day to day. This condition is caused by the uncertainty of obtaining spelter, and the prices asked for it. Galvanized sheets are given at from 3.40c to 3.45c, for 28 gage, and black sheets at from 1.85c to 1.90c for 28 gage, both Pittsburgh basis.

Canal Freights Again Rise

Philadelphia, March 23.—Notice of another advance of $2 a ton to 55 cents per 100 pounds for shipment from New York to the Pacific coast by way of the Panama canal has been served upon eastern Pennsylvania sheet makers by the steamship lines. This tends to further increase the hesitancy of Pacific coast buyers to act before the new overland freight rates, now being framed, are announced. It is expected that the new transcontinental rail rates will be put out in the near future. The market with eastern Pennsylvania sheet makers continues narrow. The situation is almost of day to day character though the orders received in the full week usually take about a capacity output. The minimum of prices is 1.459c, Philadelphia, or 1.30c, Pittsburgh, for No. 10 gage blue annealed and some business is going at 1.35c, Pittsburgh. An effort is being made to obtain some advance on Pacific coast business.

Tin Plate For Export

Pittsburgh, March 23.—The American Sheet & Tin Plate Co. has taken 70,000 boxes of tin plate for export to China, and numerous other orders for shipment to foreign countries have been received this month. Domestic demand continues heavy, and the American Sheet & Tin Plate Co. continues to operate tin plate mills at about 95 per cent capacity. All of the 32 mills of the Jones & Laughlin Steel Co. are active.

Coke Market Stirring

Important Consumer Negotiates for Blast Furnace Requirements After July 1

Pittsburgh, March 23.—A prominent western Pennsylvania consumer has opened negotiations for blast furnace coke requirements after July 1, and may buy for 12 months if operators are willing to sell at attractive prices. The contract would involve from 25,000 to 30,000 tons of fuel a month, under normal conditions. The Perry Iron Co. has bought about 12,000 tons of furnace coke for delivery over a 30 days' period, at its Erie, Pa., furnace, and the Girard Iron Co., Girard, O., has entered into a contract for a year's supply of fuel with a Pittsburgh seller. While full particulars have not been announced, furnace coke for future shipment seems to be quotable at a spread from $1.60 to $1.70, ovens, depending upon the length of the contract. Spot furnace coke is selling as low as $1.50, ovens. An eastern blast furnace interest continues to figure on about 10,000 tons a month for future shipment. Foundry fuel is selling at a wide spread in prices. The Connellsville *Courier*, for the week ending March 13, says production was 279,727 tons, an increase of 5,075 tons compared with the week before. Reports that the Carnegie Steel Co. plans to erect a by-product coke oven plant at its Mingo Steel Works, Mingo Junction, O., are officially denied. The Cambria Steel Co., Johnstown, Pa., has awarded a contract for the erection of 43 by-product coke ovens to the H. Koppers Co.

Inquiry in East

Philadelphia, March 23.—Two eastern Pennsylvania blast furnaces are in the market for their requirements of coke for the rest of the year estimated at 5,000 to 6,000 tons monthly each. There has been practically no buying of furnace coke in the east in late months. Those furnaces which recently have resumed have been drawing against old contracts. It is understood a lake furnace recently paid $1.75, ovens, for some tonnage for last half.

Coke Drifting

Cincinnati, March 23.—Foundry coke is moving forward on contracts in a satisfactory manner, and shipment on furnace coke is being withheld only in a few instances. Operators in the Pocahontas, New River and Wise county districts are keeping only enough ovens in blast to supply contracts. New inquiries and sales are very scarce, and are limited to small lots. The yearly buying movement for foundry coke will not begin for another month, and very few furnaces will need new supplies until towards the second half. Prices are unchanged on all grades of southern coke.

Sale of 5,000 Tons

St. Louis, March 23.—One sales agent reports a sale of 5,000 tons of furnace coke last Friday, and insists that the tentative inquiry for upwards of 50,000 tons, which has been on the market several weeks, has not been withdrawn. Connellsville and Virginia 72-hour foundry coke is held at $2.25 to $2.50, ovens.

McCord & Co., manufacturers of railway appliances, have removed their general offices from the Railway Exchange building, Michigan avenue, Chicago, to the plant in West 120th street, West Pullman.

(*For complete prices see page* 642.)

Works Bid For Scrap

And Give Market a Better Appearance in the East—No Buying at Chicago—Irregularities in Other Cities

Philadelphia, March 23.—A sounder appearance to the recent and continued advance in heavy melting steel and certain other grades in this center, is imparted by the higher offers which are being made by consumers. This is conspicuously true in steel scrap, which holds the stage in interest and activity. Recently the bids of the brokers, some of which have appeared to be speculative, have fixed the high mark on this grade. These interests still offer $11.25, delivered, eastern Pennsylvania, with higher reported, but some of the makers now are bidding against them for material. It is reported, though not yet confirmed, that one important mill paid $11.50, delivered, for a tonnage. It is known that certain eastern Pennsylvania works have been offering over $11, delivered, and one company bought a fair tonnage at $11, delivered. The eastern market on steel appears to be placing itself on a parity with the recent Pittsburgh advances. Other grades than steel are quiet, though firm. Small sales of wrought pipe at $10.50, delivered, and of No. 1 railroad wrought at $12.50, delivered, have been closed. One iron mill has paid $8.75, delivered, for turnings, but other consumers offer only $8.50, delivered. Frank Samuel has been awarded the 1,000 tons of iron scrap from the Washington avenue pier, this city, of the Pennsylvania railroad. Italy's attractive offers for iron and steel scrap still bring no response from this side, because of high freights and general uncertainties regarding the war position of that country.

Dealers Optimistic

Cincinnati, March 23.—The iron and steel scrap market is at a standstill. Foundries are consuming a fair amount of old materials, but rolling mills are withholding shipments, so that the favorable movements on the part of the smaller melters are more than counterbalanced. More scrap is being shipped to consumers outside of the city than to local users. Prices are unchanged on all grades, but are fairly strong because of the optimistic feeling in the market that conditions will improve in the near future.

No Buying of Scrap

Chicago, March 23.—Lack of buying by scrap users is resulting in quotations remaining practically at the same level for several weeks. Large buyers took sufficient tonnage some time ago to care for their requirements through a considerable period and brokers for the most part have covered for delivery on these contracts. No other buying has taken place since and prices have remained practically stationary, with some slight softening on various grades. It is believed a buying movement would result in prices declining considerably, as stocks of scrap are large and railroad offerings are sufficient to bring about further softness.

Lists offered by railroads aggregate 8,500 tons, as follows: Great Northern, 1,600 tons; Burlington, 2,700 tons; Illinois Central, 3,600 tons; Southern railway, 500 tons, and the Wabash, 50 tons.

Firm at St. Louis

St. Louis, March 23.—The scrap market remains firm, and while the consumers are unwilling to come into the market, there is little tendency toward a reduction of prices. Railroad lists out this week are: Union Pacific, 2,750 tons, of which 500 tons are for long-length rails; Missouri, Kansas & Texas railroad, 1,600 tons, of which 350 tons are No. 1 railroad wrought.

More Activity

Buffalo, March 23.—More activity was noted in the Buffalo district than has been apparent for some time. A considerable tonnage was booked by the local yards. Heavy melting steel figured most prominently in the trading of the week, the purchases being made largely by Pittsburgh consumers. Turnings and borings were next in order in the volume of trading.

A disposition has developed among the selling interests to close at prices slightly above the level prevailing for a number of weeks, for deliveries over second quarter. The yards of the district feel that conditions do not appear to be favorable to obtain for some time a higher level of prices.

Heavy Melting Higher

New York, March 23.—Bidding by the brokers and by some of the eastern Pennsylvania mills for heavy melting steel, have brought about some activity and many reports in that grade in this market the past week. Higher prices have been established in this grade although not as high as some of the reports have indicated. Consumers appear actually to have paid $11.25, delivered eastern Pennsylvania, equivalent to $9.35, New York, but rumors of large sales at $11.50, delivered eastern Pennsylvania, cannot be verified. It also is known that some smaller tonnages have been taken by eastern Pennsylvania consumers at $11, delivered. Brokers have not stopped at offers which are the equivalent of $11.25, delivered eastern Pennsylvania, and it is said have gone to $11.50, delivered. The exact market on a tonnage of steel to consumers is somewhat indefinite, in view of the activity of middlemen, but higher prices undoubtedly would have to be paid. Outside of steel, the market has shown no particular change, but appears firm.

(*For complete prices see page* 642.)

Wire Prices

Generally Firm in Spite of Some Irregularity in Galvanized

Cleveland, March 23.—The wire market continues active and prices are being remarkably well maintained by both jobbers and manufacturers. In spite of reports that recent advances in extras on galvanized are not being maintained, the American Steel & Wire Co. is adhering rigidly to the advances and the opinion is expressed that, owing to the high price of spelter, all other companies will very soon find it absolutely necessary to get the higher prices.

Galvanizing Advance Uncertain

Pittsburgh, March 23.—The advance of 10 cents per 100 pounds for galvanizing wire products, the second to be announced within a month, was adopted by most makers last week, but it since develops that new quotations are not being asked in all instances. Some makers report difficulty in getting away from the extra prevailing before spelter started to advance by leaps and bounds. Unless the present price of spelter is maintained for a considerable period, it is not believed the 60 cents differential for galvanizing wire will be established. The domestic situation shows no snap, but foreign demand is keeping mills busy in all departments.

Warehouse Business Improves

Cleveland, March 23.—Warehouse business in the Cleveland district is showing very encouraging improvement. The two leading warehouses report a gain of about 30 per cent for the first three weeks of March as compared with the same period in February.

Higher Prices on Plates

Are Named for Export, But Domestic Market Drags and 1.10c, Pittsburgh, is Freely Done

Philadelphia, March 22.—Continued advance in the British plate market now is bringing prices close to the point where eastern Pennsylvania makers can do business without considerable sacrifice. Cable advices the past week state that ship plates now are quoted at £9, or $43.20, delivered, at British buying points. Eastern Pennsylvania makers within the week have captured several small lots of plates for that destination on which they have obtained about 1.25c, New York, as the business was taken on a freight-alongside basis. This is equivalent to about 1.14c, Pittsburgh, as the export freight is 11.3 cents per 100 pounds. Exporters in this city some weeks ago were able to quote plates at £8, or $38.40, delivered, British Isles, and now expect to receive these orders, though closing advices yet are awaited. The eastern plate market remains irregular both in volume and in price. Lack of railroad buying already is felt by all the mills. Some makers report their volume continues less than two weeks ago. Recent railroad orders have directed some tonnage to eastern mills. The Worth Bros. Co. will supply about 1,000 to 1,200 tons for the recent order of the Missouri, Kansas & Texas and will divide with the Lukens Iron & Steel Co. and the Carbon Steel Co., the 1,250 to 1,500 tons for the Burlington locomotives which will be built by the local works. No further marine contracts of importance have been closed. The government will take bids April 27, on a steel lighthouse tender to require 700 to 800 tons of steel. The Jones & Laughlin Steel Co. has been awarded 175 tons additional of cylinder plates for Panama. Makers are able to obtain 1.309c, Philadelphia, or 1.15c, Pittsburgh, only on small lots. Large orders readily go at $1 less. It is significant that certain makers who are insisting on the full new price make unquestionably the most unfavorable report in new business.

Plate Demand Continues

Pittsburgh, March 23.—Plate mills continue fairly busy in western Pennsylvania, and prices appear firmer than a week ago. Sentiment among mill managers is much better and greater confidence is expressed regarding the future. While the market has been irregular in some sections, mills in the immediate district have been able to obtain the current quotation for spot shipment.

Weak at Cleveland

Cleveland, March 23.—The plate market is weak and, with the exception of two or three of the larger companies which have been endeavoring to maintain the 1.15c, Pittsburgh, price, 1.10c, Pittsburgh, is freely quoted. The demand is light and the outlook is that mills in the Cleveland district will have difficulty in maintaining their present rate of activity.

Plates Are Weaker

Chicago, March 23.—Evidences continue to multiply that quotations are not being maintained on steel plates and business has been placed recently at 1.29c, Chicago mill, with rumors of 1.25c, Chicago, being obtainable. The latter figure is not verified as having been done in an actual transaction. Conditions which have assisted the plate market in the east are not present in this market and lack of car buying is a strong factor in preventing plates gaining strength.

Bolts and Nuts

Prices Somewhat Advanced Owing to Improved Conditions

Cleveland, March 22.—Conditions in the nut and bolt market are more favorable and owing to improvement in buying and specifications prices have been advanced somewhat. Carriage bolts, ⅜ x 16-inch, smaller and shorter, rolled threads, are now quoted at 80 and 15 discount, as compared with 80 and 20. Cut threads have been advanced to 80 and 10 from 80 and 15. Machine bolts with hot pressed nuts, ⅜ x 4 inches, smaller or shorter, rolled, are now quoted 80 and 20, an advance from 80 and 25. Hot pressed, square, blank or tapped nuts are quoted $6.40 off list instead of $6.50. Hot pressed hexagon, blank or tapped, are quoted $7.30 to $7.40 off instead of $7.40 off. Smaller rivets, 7/16-inch and smaller, heretofore quoted 80 and 25 off, are now quoted 80 and 20 off.

New Ordnance Company.—The International Steel & Ordnance Co. has been chartered at Trenton, N. J., with a capital of $100,000, by Harry H. Pickering, Chas. O. Geyer and L. Matthews. The company's headquarters are at East Orange, N. J. The objects of the company are to "make, finish and assemble products of steel or other metal as may be requisite for the production of large and small arms and to contract with other parties therefor."

(*For complete prices see page 642.*)

Forging Demand

Is Increased by Orders for War Purposes

Philadelphia, March 22.—War orders for machinery placed in this country are directing a better demand for forgings to the manufacturers of this class in eastern Pennsylvania. This is the explanation for some improvement in the demand for forging billets which the mills in this district now are experiencing. Some of the forges report a marked change for the better in the volume of their business and they now are working at capacity day and night. Buyers of rolling billets in this center, however, are doing no more and the demand in this market is slack. Rolling billets are unchanged at $21.56, Philadelphia, or $19, Pittsburgh. A Philadelphia exporter has out an inquiry for 1,000 tons of sheet bars.

Sheet Bars Held at $20

Pittsburgh, March 23.—Sheet bars are being held at $20, Youngstown, for April delivery by several makers, and $1 a ton above that figure is being asked for shipment the latter part of the second quarter. The billet market is quiet, and it is difficult to determine the position of prices. Pittsburgh makers are not offering material in the open market. Specifications are described as satisfactory, comparing favorably with those of the corresponding period in February.

Heavy Specifications

Buffalo, March 23.—Agencies here report that specifications are coming in more freely against tin plate contracts. This is said to be due to a desire on the part of consumers to protect their requirements in the face of the present and the reported future scarcity of pig tin.

Koppers Gets Contract

The Cambria Steel Co., Johnstown, Pa., has awarded a contract to the H. Koppers Co., First-Second National Bank building, Pittsburgh, for the erection of 42 ovens at its by-product coke plant. The addition will not increase the size of the by-product coke plant.

Subway Work

Calls for Considerable Tonnage—Few Structural Awards

New York, March 23.—Subway railroad construction again has appeared in the metropolitan market as the result of the alien labor law through the repeal of the obstructing act. The public service commission now has in the market one section, about 5,000 tons, and others are expected to come along in the near future, as there are numerous contracts still to be let. Of the 84 sections of the city-owned lines, 64 now are under contract. In addition, there are further contracts to be awarded by the rapid transit companies. New structural steel inquiry in this territory the past week has not been so active, but it is better than a month ago. Money is easy, but there is a tendency toward conservatism on the part of the banks and large lenders to finance other than the preferred class of speculative construction in this city. Architect's boards are well occupied with projects which await the necessary money-backing to be carried out. Awards in this territory the past week did not exceed 2,000 to 3,000 tons. The absence of railroad tonnage has a depressing effect on the situation and not much hope is expressed in any important revival in that line soon. Plain material prices cover considerable spread and are not above 1.319c, New York, or 1.10c, Pittsburgh, on any sizable tonnage, while less has been done recently on the most attractive orders. Some small lots command 1.15c, Pittsburgh.

Satisfactory Specifications

Cleveland, March 23.—The structural market in Cleveland is very dull at present and no new buildings of importance are pending. Specifications during the last week have, however, been satisfactory, especially on bridge material.

Eastern Mills Doing Better

Philadelphia, March 23.—The better outlook and moderate actual improvement in the structural steel market in this territory is being sustained. Specifications against contracts are better and there is a larger miscellaneous flow of new orders which is permitting eastern Pennsylvania mills to be operated at better advantage. None of the plants however is near capacity. Mill activities at Pottsville, South Bethlehem and Phoenixville are on the increase. Architects in this and important southeastern cities are increasing their working forces owing to the greater volume of business. One of the poor spots of the structural steel trade, however, remains the light amount of railroad work. Eastern shape prices remain about as they have been. Desirable orders command 1.259c, Philadelphia, equivalent to 1.10c, Pittsburgh, or even less in exceptional cases. The amount of business at 1.15c, Pittsburgh, is small.

Shops Need Tonnage

Pittsburgh, March 23.—Despite numerous structural lettings, many of which involve heavy tonnages, structural mills in this district are not busy and fabricating shops are in need of additional work. From a sentimental standpoint, prices appear firmer, but they have not been severely tested this month. The McClintic-Marshall Co. has taken a contract for the erection of the School of Applied Design at the Carnegie Institute of Technology, which will involve 450 tons.

Shape Market Slack

Chicago, March 23.—Although the spring building season has opened, tonnages of structural shapes are not as plentiful as had been expected and for the most part only small projects are being closed. Lettings in the west during the past week aggregate 2,600 tons. Prices are being maintained closely at 1.34c, Chicago, but with rather disappointing results as to tonnage.

CONTRACTS AWARDED.

Zimmerman Steel Co., foundry building and erecting shop, Bettendorf, Ia., 368 tons, to Morava Construction Co.

Receivers of Wabash Railway Co., 240 stringer spans for repairs to St. Charles bridge, 683 tons, to Decatur Bridge Co.

City of Richmond, Cal., steel shed, Richmond, Cal., 420 tons, to Pacific Rolling Mill Co.

Central Union Trust Co., 7-story bank and office building, Jefferson City, Mo., 249 tons, to Christopher & Simpson.

Union Iron Works, San Francisco, Cal., crane runway, 700 tons, to Ralston Iron Works.

Smelter for the Tottenville Copper Co., Tottenville, S. I., 340 tons, awarded McClintic-Marshall Co.

Courthouse, Hamilton county, O., 2,900 tons, general contract awarded Chas. McCaul, Philadelphia, steel work yet to be placed.

Extensions to plant of Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., 200 tons, awarded Pennsylvania Steel Co.

High school, Huntington, W. Va., 500 tons, awarded independent shop.

Building for the Carnegie Technical Institute, Pittsburgh, 430 tons, awarded McClintic-Marshall Co.

Store building for Frank Bros., 588 Fifth avenue, New York City, 400 tons, awarded Hay Foundry & Iron Works.

Additional building for the Bridgeport Arms Co., Bridgeport, Conn., 700 tons, awarded Lackawanna Bridge Co., about 3,500 tons of work still pending.

Extension of the plant of the National Lead Co., Long Island City, 250 tons, awarded Hedden Iron Construction Co.

(*For complete prices see page* 642.)

Bridges for Southern railroad near Charlotteville, Va., 500 tons, awarded independent shop.

State hospitals, Ward's Island, N. Y., 250 tons, awarded independent shop.

School of Applied Design, Carnegie Institute of Technology, Pittsburgh, 450 tons, awarded to the McClintic-Marshall Co.

CONTRACTS PENDING.

Signal bridges for Delaware, Lackawanna & Western railroad, 400 tons, bids being taken.

Bridge work for Lehigh valley railroad, 400 tons, bids being taken.

Superstructure of buildings at Mt. Pleasant, Westchester county, New York, for Board of Water Supply, about 300 tons, bids taken.

Plate girder bridges, for Chiriqui Railroad of Chile, 200 to 300 tons, bids being taken.

Addition to Hotel McAlpin, Thirty-third street, New York, 1,000 tons, bids being taken.

Section No. 4 of the Broadway-Fourth avenue subway line, 4,860 tons, bids advertised for April 20.

Lehigh Valley passenger terminal, Buffalo, 4,000 tons structural, bids go in this week, Kenneth Murchison, New York City, architect.

Buffalo, Rochester & Pittsburgh Railroad Co., six bridges, including viaduct 263 feet long over Erie canal at Sugar Lake Junction, requiring in all about 1,000 tons structural, to take bids soon.

Foreign Ore

Being Brought by a Few Ships Owned by Sellers

Philadelphia, March 23.—A few cargoes of transatlantic iron ore continue to arrive at eastern ports. This ore usually is coming forward in ships controlled by the sellers. A cargo of Spanish low phosphorus ore is en route to an eastern Pennsylvania buyer and some further arrivals of Swedish ore are expected. So far this year but four cargoes of Swedish and one of Spanish ore have arrived at Philadelphia. Cuban and Chilean shipments are coming forward, but are less than usual. There is nothing of interest on the market side in the eastern ore situation.

Will Delay Market

Cleveland, March 23.—The selling of very large tonnages of pig iron in the Buffalo district at low prices will probably have the effect of delaying the opening of the iron ore market, for, after the very unsatisfactory conditions of the past year, ore sellers are not willing to begin selling unless they can see some prospect of fair prices. The present outlook is that the opening of the season on the lakes will be late.

W. W. Rosser, who has been manager of western sales of the T. H. Smythington Co., Rochester, N. Y., has been appointed vice president, with headquarters at Chicago. Mr. Rosser has been connected with the Smythington company since 1903. Prior to that time, he was with the Washburn Coupler Co.

Spelter is Unsettled

On Account of Low Quotations on New York Metal Exchange, But These Do Not Represent the Market

New York, March 23.—The spelter market again is unsettled by reason of further low quotations on the New York metal exchange. Two carloads of April shipment were sold on the exchange today at 8c and 8.50c, St. Louis. In addition asking prices were recorded as follows on St. Louis delivery: May, 7.87½c; June, 7.50c. That these sales were made for effect and that they do not represent the market is doubted by no one. In fact, efforts which have been made to buy outside of the exchange at the prices registered on the exchange have proved unfruitful. It is entirely unlikely that these prices on prime western could be shaded outside of the exchange: Spot and the early part of April, 9.75c to 10c, St. Louis; latter part of April and May, 9.50c, St. Louis; June and July, 9.15c to 9.25c, St. Louis. In fact, actual transactions yesterday and today have realized higher prices on each position. The basic situation in the market remains unchanged as sellers are just as thoroughly sold ahead as before, and domestic consumers in the main are uncovered for the early supplies. In addition, there has been a heavy foreign inquiry the last few days. Altogether, the situation in spelter, despite the recent continued manipulation, is very strong.

The most interesting development in the tin market is the order of the British government forbidding exports excepting under special licenses, these licenses to be granted only on such cargoes as are consigned to British consul at the ports of destination. This order, it is believed, is designed to prevent shipments of tin into Germany by way of neutral European countries, and no trouble is expected in getting supplies into this country. While the London market has declined spectacularly as a result of this order, the market here has advanced due to a scarcity, only 510 tons of tin having arrived here so far in March. At the same time, the high prices here have scared away buyers, so that prices today are largely nominal. Spot can be had at something between 52 and 53c; March at about 51c; April at about 41c; May at about 39c.

Prices on copper are ascending, due to advances in London. Electrolytic is held at 15.25c to 15.37½c, delivered 30 days, which still is about ¼c below the parity of the London price. The best brands of lake are held at 16c, cash, good ordinary brands at 15.50c, cash, and arsenical brands at 15.25c, cash. Electrolytic has been in good demand for export recently. Lake also is well sold ahead.

The lead market is very strong, the leading producer advanced its asking prices to 4.10c, New York, and 4.02½c, St. Louis, and another advance now is expected. Independent producers quote the market 4.05c to 4.10c, St. Louis. Demand for export has been especially good.

Stocks of antimony are extremely limited, especially in the better brands, supplies of which have been cut off by the war. Cookson's is obtainable only in one or two cask lots, at about 30c, duty paid. Chinese and Japanese are obtainable at 21.50c to 22c, duty paid. Offers of future Chinese and Japanese are limited, at about 19c, in bond.

The aluminum market continues very strong. Spot is quotable at 19c to 19.12½c, New York and Niagara Falls. No offers are heard on futures.

Ferro Users

Are Showing Less Anxiety, But Outlook is Still Uncertain

New York, March 23.—Representatives in this country of English makers of ferro-manganese still are in the dark as to when the promised renewal of deliveries on old contracts will take place. No definite advices from England regarding this matter have been received during the past week and the situation remains enshrouded with the same uncertainty as previously. In the absence of any announcements of makers to the contrary, however, it is expected that the plan for bringing in about 2,500 tons weekly, will be carried out, eventually.

It is worthy of comment that consumers in this country now are showing less anxiety over additional supplies than they were a few weeks ago. Apparently they entertain confidence that the embargo will be lifted in plenty of time to spare them any serious shortage. About all the selling of ferro-manganese that now is being done consists of the small quantities of ground and lump going to the foundries and smaller consumers. A lot of five tons was sold at 6¾ cents per unit, or $150.60 per ton, at eastern seaboard, smaller lots of lump or ground commanding 7 to 7½ cents at the plant or warehouse of the grinder. The price for carloads on large amounts remains at $78, seaboard, for delivery when shipments are resumed.

Some foreign inquiry for ferro-alloys is in the market. Japan has been a considerable buyer of the higher grades of ferro-silicon and has purchased about 150 tons, including some 50 per cent. An inquiry also is current through exporters for 500 tons of ferro-manganese, 250 tons of 75 per cent ferro-silicon and some ferro-chromium, but the purchasing country has not been designated.

(*For complete prices see page* 642.)

Many Inquiries

Pittsburgh, March 23.—Alloy sellers in this district have been receiving numerous inquiries, but sales have not increased in volume. Ferro-manganese is listed at $78, seaboard, for future and from $90 to $100, seaboard, for prompt shipment, but the market shows no snap. Spiegel is nominally quoted at $28, furnace, but that figure is being shaded in isolated instances. Ferro-molybdenum and ferro-tungsten show some life, but prices are irregular. Manufacturers of special steels seem to have covered vanadium requirements some time ago, since no new demand is noted; this alloy is quotable at a spread from $2.25 to $2.75 per pound of contained alloy. Ferro-carbon titanium is listed at a spread from 8c to 12½c per pound.

Buys Pipe

Philadelphia Co. Places Order for Wrought for the Year

Pittsburgh, March 23.—The Philadelphia Co. has covered its wrought iron pipe requirements for the year, having distributed orders for about 3,000 tons, ranging from ¼ inch to 10 inches in diameter. The iron pipe tonnage involved for proposed work this year is about 60 per cent of that ordered for 1914. The order includes tubing, casing and drive pipe. An order for from 28 to 30 miles of 8-inch steel line pipe has been placed in this district. Iron steel pipe mills are comparatively active, some of them operating at 75 per cent of capacity, and above. Discounts are reported to be firmly maintained. Boiler tubes show no snap and prices are still irregular.

Taking Their Quotas

Buffalo, March 23.—Jobbers are taking their full quotas on contracts, availing themselves of the November price card effective until April 1. This inflow of specifications has developed considerable activity.

Rail Orders

Are Few and Car Buying Limited—Cleveland Buys Ties

New York, March 23.—An order for 478 steel car bodies for subway and elevated railroad coaches has been awarded to the Pullman Co. by the Interborough Rapid Transit Co., of this city, in compliance with a recent order of the public service commission. These bodies will require about six tons each, making the total steel requirement about 2,900 tons. Other car orders are few and of small importance. Bids are in on the Missouri, Kansas & Texas inquiry for 1,200 cars and are being considered at St. Louis. It now is learned that the Haskell & Barker Car Co. will fill the recent order of 500 refrigerators for the Santa Fe instead of the American Car & Foundry Co. The Grand Trunk is inquiring for 60 tank cars and the Illinois Central lot of 100 gondolas still is open.

In locomotives, the Missouri, Kansas & Texas has placed 40 with the American Locomotive Co., the Vandalia is in the market for 25 and the Montour for five. The Chesapeake & Ohio still figures on 20.

Rail orders the past week have been small. The Pennsylvania Steel Co. has taken 650 tons of tee rails for a southern road and 500 tons of girders for a middle western traction company. The Bethlehem Steel Co. will furnish 1,000 tons of the recent Burlington order. The French government is in the market with a new inquiry of 15,000 tons additional of light rails.

The New Haven railroad still is negotiating for 15,000 kegs of standard spikes.

Portable Track Contract

The Carnegie Steel Co. has taken an order for 600 tons of steel ties for the Cleveland Railway Co. The Lakewood Engineering Co., Lakewood, O., has entered into a contract with the French government for 30 miles of portable track. The company will purchase about 1,500 tons of steel and assemble it for shipment. The contract amounts to more than $100,000.

Inquiring for Rolling Stock

St. Louis, March 22.—The Missouri, Kansas & Texas railroad has asked shops to bid on specifications for the construction of $2,000,000 worth of new railroad rolling stock—engines, coal cars and passenger coaches. The inquiry was mailed to railroad supply companies March 1. The contracts may be closed in 30 days, if the officials of the road decide that the work can be financed. Much depends upon the conditions of the money market. The inquiry says the road has in mind the construction of 30 freight engines of the Mikado type, five passenger engines of the Pacific type, 15 steel passenger coaches and 1,000 coal cars.

Pipe Foundries

Well Supplied With Orders of Smaller Sizes—Some Advances

New York, March 23.—Eastern cast iron pipe foundries now are well occupied with 4, 6 and 8-inch sizes for about 60 days ahead, but could handle considerable more tonnage of the larger diameters. The market shows as many inquiries as during the brisker period recently, but the tonnage is less, since most of these are small singly. Makers are able to obtain some advances, notably on the smaller pipe. R. D. Wood & Co. have taken 350 tons of 8 to 30's for Fall River, Mass., at $20.80, delivered. The Warren Foundry & Machine Co. has 148 tons of 6 to 12's at $21.50, delivered, for Woonsocket, R. I.; 300 tons of 6 to 12's for Gloucester, Mass., at $21.50, for the 10's and 12's and $22 for the 6's and 8's, and 150 tons of 6's and 8's for Framingham, Mass. The Central Foundry Co. has taken 650 tons of 12-inch universal pipe for Binghamton, N. Y. New inquiries include 789 tons of 6 to 14's with an alternate of 461 tons of 14's for Wellesley, Mass., March 26; 181 tons of 6 and 8's for Brockton, Mass., March 26; 116 tons of 6 to 12's for Everett, Mass., March 25; 638 tons of 4 to 12's for Richmond, Va., March 26; the New York board of water supply will take bids March 26 on 653 tons of 6 to 12's. Bids are in on 179 tons of 6 to 10's for Harrisburg, Pa., on 270 tons of 8 to 12's for Syracuse, N. Y., and on 226 tons of 6 to 10's for the Panama canal. Brazil is in the market for a small lot.

Lull in Cast Iron Pipe

Chicago, March 23.—Something of a lull has taken place in competition for municipal necessities in cast iron pipe, the present week offering practically nothing of interest. However, some awards have been made in cases where delay was encountered and fair tonnages are involved. The United States Cast Iron Pipe & Foundry Co. has been awarded 2,500 tons at Akron and 1,200 at Duluth. The Lynchburg Foundry Co. has been awarded 3,000 tons at Grand Rapids, Mich., conditional on securities being sold by the city to cover the cost.

(For complete prices see page 642.)

Exports Grow

January Shows Gain—Increase in Machine Tools and Trucks

The government report on iron and steel imports and exports for January, and for the seven months ending with January, shows that exports for January amounted to 139,788 tons, compared with 118,769 tons in January, 1914, and 117,762 tons in December, 1914. Comparing December, 1914, with January, 1915, exports of billets, ingots and blooms increased from 3,400 tons to 16,046 tons. Steel bars declined from 22,002 tons to 17,933 tons. Sheets and plates increased from 17,332 tons to 21,426 tons. Tin and terne plates increased from 3,977 tons to 7,014 tons.

Last December, iron ore imports were suspended entirely, except from Cuba, from which island 51,053 tons were received. Shipments from Spain, Sweden and other countries were resumed in January, when the total imports amounted to 75,286 tons.

In machinery, the value of the exports in January, 1915, was $7,676,078, compared with $8,122,529 in January, 1914, and $6,372,041 in December, 1914. The value of the exports of machine tools for last December was $2,432,331,

IRON AND STEEL IMPORTS, GROSS TONS.

	January,		Seven months ending January,	
	1915.	1914.	1915.	1914.
Scrap	2,383	1,285	21,406	19,769
Pig iron	2,990	4,001	80,179	78,731
Ingots, blooms, billets of steel	2,016	3,399	20,476	18,627
Wire rods	342	1,162	2,382	7,923
Rails	305	1,224	14,842	8,697
Bar iron	551	2,112	8,148	15,259
Structural	316	709	4,936	6,216
Sheets and plates	58	155	2,005	1,312
Tin and terne plate	1,608	3,689	4,290	12,781
Total	10,569	17,736	158,664	169,315

IRON AND STEEL EXPORTS, GROSS TONS.

	January,		Seven months ending January,	
	1915.	1914.	1915.	1914.
Scrap	1,327	6,160	10,610	51,591
Pig iron	8,862	12,852	52,275	143,837
Billets, ingots and blooms of steel	16,046	2,864	39,598	22,846
Wire rods	8,234	869	31,612	18,882
Steel rails	8,864	17,625	73,859	246,553
Steel bars	17,933	9,510	81,358	99,041
Iron bars	391	371	3,410	8,464
Struc. iron and steel	10,833	15,610	89,300	207,964
Hoop, band and scroll	1,020	1,015	6,045	7,593
Sh't & plates	21,426	16,951	138,374	226,264
Tin & terne plates	7,014	2,351	40,014	23,079
Barbed wire	9,530	5,893	67,528	49,846
All oth. wire	9,501	4,230	56,348	48,373
Cut nails	218	186	1,163	2,233
Wire nails	5,837	2,831	26,175	22,942
All oth. nails incl. tacks	197	205	1,987	1,996
Pipes & fit	10,812	16,683	105,944	152,929
R. R. spikes	214	270	3,171	5,024
Bolts, nuts, riv., washers	985	1,631	7,374	12,721
Horseshoes	416	108	5,702	706
Cast radiators	128	554	1,863	4,185
Total	139,788	118,769	843,710	1,357,069

while in January it was $2,903,740, compared with $966,545 in January, 1914.

Of automobiles, 45 commercial, valued at $74,491, and 2,481 passenger, valued at $2,174,392, making a total of 2,526 machines, valued at $2,248,833 were exported in January, 1914, while in January, 1915, the exports consisted of 935 commercial, valued at $2,545,527 and 1,803 passenger, valued at $1,313,153, making a total of 2,738 cars, valued at $3,858,680. Last January, five aeroplanes were exported, valued at $71,315, while in January, 1914, two were exported, valued at $12,500.

IRON ORE IMPORTS, JANUARY.

	Tons, 1915.	Tons, 1914.
Spain	5,193	.....
Sweden	7,067	11,933
Canada	138	2,785
Newfoundland and Labrador	.....	.....
Cuba	54,850	79,320
Other countries	8,038	7,766
Total	75,286	101,804

Imports of ore and calamine in January, 1915, were valued at $23,369, compared with $12,195 in January, 1914.

Book Review

"The A B C of Iron and Steel" with a directory of the iron and steel industry, written by the collaboration of 15 authors and edited by A. O. Backert; 354, 8 x 11-inch pages, bound in cloth or leather; 222 illustrations; issued by the Penton Publishing Co., publisher of *The Iron Trade Review*, Cleveland; price, $5, postpaid.

Although the literature of the iron and steel trade industry is extensive, practically all of it is of a technical nature which presupposes a considerable knowledge of all branches of the business on the part of the reader. The industry, however, is so large and its ramifications so extensive that there are a great many persons connected with it who have had no opportunity to become personally familiar with all of its phases. Also, there are a large number of people in various walks of life who are anxious to become familiar with the methods and processes of one of the world's greatest industries. Every well educated man, be he engineer, attorney or salesman, should have a broad, practical knowledge of the whole scope of the iron and steel business. For this reason, the demand for an elementary work covering not only the practical but the commercial phases of the industry has been insistent. It is for the purpose of meeting this demand that the "A B C of Iron and Steel" is offered. This volume is intended to furnish a simple, concise, but at the same time comprehensive exposition of the primary processes involved in the conversion of iron ore into finished forms. Its scope is accurately indicated by its title. No effort is made to furnish an exhaustive treatment of the subject; instead, the aim is to present the leading facts regarding the manufacture of iron and steel in graphic, readable language, free from technicalities.

The subjects are treated in natural sequence. Five chapters are devoted to iron ore, covering thoroughly mining operations, beneficiation, transportation, handling problems and valuation. Separate chapters are devoted to beehive and by-product coke. Following this, the book takes up the manufacture of pig iron, wrought iron, crucible steel, bessemer steel and open hearth steel. After covering the manufacture of the primary materials, their conversion into finished forms is considered and chapters are presented on the rolling mill industry, on wire and wire rods, on the production of gray iron, malleable and steel castings and on the manufacture of electric steel.

Each process is described by a man who is a recognized authority on the principal subject on which he writes—an established leader in his field. The book, therefore, represents the thorough knowledge and years of practical experience of the foremost men in every branch of iron and steel making. The authors include such men as John Birkinbine, Philadelphia, the leading authority on iron ore; Kenneth Seaver, chief engineer, Harbison-Walker Refractories Co., Pittsburgh; F. H. Kindl, consulting engineer and former partner of Andrew Carnegie; Kenneth B. Lewis, manager of the wire drawing machinery department of the Morgan Construction Co., Worcester, Mass., and R. A. Bull, manager of production, Commonwealth Steel Co., St. Louis, and president of the American Foundrymen's Association. In dividing the work among a number of contributors instead of presenting a volume embodying ideas of a single author, who would necessarily have a somewhat limited vision regardless of his capabilities, an opportunity was created to present each subject in an adequate, comprehensive and accurate manner. At the same time the reader receives the benefit of a variety of viewpoints.

It is a common-sense book written expressly to fill the needs of every man affiliated with or in any way interested in the iron and steel industry. Technical language and long discussions of mechanical details have been carefully avoided; each chapter is written in simple everyday English. Nevertheless, an effort has been made not to sacrifice accuracy and completeness for the sake of simplicity.

To show the commercial as well as the manufacturing progress of the iron and steel business, several pages of statistical matter are presented covering the production, the imports and the exports of every iron and steel product from earliest records down to the present time. The shipments from each of the mines on the Lake Superior ranges also are carefully tabulated, thus furnishing a complete statistical survey of the growth of the iron and steel business in the United States.

Directory a Feature

The book also includes a directory of the iron and steel works of the United States and Canada, giving the names of companies, their products and the names of their officers. The directory is classified according to names of companies, and also according to products. It was carefully compiled from original data collected during the closing months of 1914 and was revised up to the time of going to press. It therefore constitutes the only complete, up-to-date directory of the iron and steel business in existence, giving not only the names of the companies and what they manufacture, but the names of their executives, including purchasing agents. An effort has been made to treat the entire subject along lines that are essentially American, it being the intention of the publisher to present a book which will serve to epitomize the progress of the iron and steel industry in the United States.

Some Activity in Steel Bars

New York, March 24. (By wire.)—Some implement makers who underestimated their needs to July 1 are now placing supplemental orders for steel bars. The contracting movement beyond July 1 by these consumers, however, is not yet under way. Several second quarter contracts, principally bars, which are firm, are reported by makers at 1.20c, Pittsburgh.

Some large sellers of southern pig iron refuse to shade $9.50, Birmingham. An offer of 10,000 tons at $9.25 yesterday was declined by one maker.

Milton C. Stuart, assistant steam engineer for the Cambria Steel Co., Johnstown, Pa., has been appointed mechanical engineer at the United States naval engineering station at Annapolis, Md., where he will begin his new duties about April 1.

Great Engineer Passes Away

.Death of Frederick W. Taylor Comes Unexpectedly—Men Who Knew Him Best Tell of His Life and Achievements

OF THE life and services of Frederick Winslow Taylor, who died of pneumonia at Germantown, Pa., Sunday, March 21, aged 59 years, men who had been intimately acquainted with him for years write for *The Iron Trade Review* as follows:

FREDERICK WINSLOW TAYLOR

By Robt. I. Clegg

Only a few weeks ago Mr. Taylor was in Cleveland and in other cities of the central west addressing large audiences upon scientific management, a subject that of recent years has been more intimately identified with his name than with that of any other man. During this trip west he seemed to be in splendid physical condition and apparently his one anxiety was of Mrs. Taylor, whose health, for some time, has been far from good.

Report came from him after leaving Cleveland that intimated he had incurred a cold immediately after giving an address at Youngstown. This indisposition assumed a more serious form after his arrival home, but his death comes as a great sorrow least expected by his many Cleveland friends who so lately saw him enjoying robust health.

Born in 1856 at Germantown, Pa., Mr. Taylor received his primary education in this country, and in France and Germany. He studied at Phillips Exeter Academy in order to enter Harvard University at the age of 18 with the class of 1874, but his impaired eyesight compelled him to change his plans even on the eve of joining the class.

He returned home with a determination to serve an apprenticeship to an engineering trade until restored health would permit him to resume college work. Arrangements were completed for him to spend four years training at the trade of the patternmaker and machinist.

Dull times marked the close of his apprenticeship in 1878 and he cheerfully accepted a position as laborer with the Midvale Steel Co., of which that able engineer, William Sellors, was president.

Mr. Taylor's aggressive ability soon earned him the place of shop clerk and later he was put in charge of the toolroom. Here he noted the waste time occasioned by each man grinding his own tools and he got the approval of the company to have a workman assigned to this duty. He followed up this progressive step by the invention of the Taylor grinder to do the work with increased accuracy and speed.

Promotion from one place of responsibility to another sufficed in six years to make the laborer of 1878 the chief engineer of the Midvale Steel Co. But during this period he had not forgotten his interrupted career at college. At night he had studied the engineering course required by Stevens Institute and in three years, in 1883, he was given the coveted degree of M. E.

Leaving the Midvale Steel Co., in 1890, he undertook a three-year contract as manager of the Manufacturing Investment Co., operating large paper mills in Maine. When his contract expired, Mr. Taylor devoted his attention to the introduction of his methods of management and organization into various plants and in the course of this work he patented many inventions.

The Bethlehem Steel Co., finding in 1898 the forge shop output was much greater than the machine shop capacity to handle it, the company retained Mr. Taylor to solve the problem. Experiments made at Bethlehem with the collaboration of Maunsel White, resulted in the discovery of the Taylor-White process of heat treatment and increased cutting efficiencies from 100 to 200 per cent. Estimates of the

gains made by the use of this steel treatment and of the improved shop system at Bethlehem introduced by Mr. Taylor were reported to the American Society of Mechanical Engineers as being 500 per cent increased production. Instead of a larger machine shop, an enlargement was made necessary in the production of the forge plant.

A paper on a "Piece Rate System and Shop Management", presented by Mr. Taylor to the American Society of Mechanical Engineers, explained his methods and these particulars were afterwards extended in two books on the subject. He had also done work in collaboration on a treatise upon concrete. His presidential address to the American Society in 1906 was on the "Art of Cutting Metals" and has been rated as a most valuable and exhaustive monograph.

The University of Pennsylvania, in 1906, conferred the degree of Doctor of Science upon Mr. Taylor.

His ideal of the skilled workman was the modern surgeon. Surgery's rigid and mechanical rational art was to him a model in its skilled exercise, its wealth of stored knowledge, and the established methods of practice and teaching that are peculiar to it. Long had he regretted that the craft of the trades is handed down from one workman to another by example and precept almost as in medieval days. So much was on file and at hand about every detail of machinery, and so little was to be found that dealt scientifically with the shop capabilities of the men making the machines, that Fred W. Taylor had a lively and cherished ambition to secure and compile all that he could obtain of this class of information. He had with him in Cleveland several comprehensive manuscripts dealing with shop methods and he told with very great satisfaction of the work that is under way along this line and from which much would undoubtedly be heard during the next few years. Sad it is to think of these plans cut short for him with little warning. But they will be carried forward by the friends and co-workers whom Fred W. Taylor has inspired. For, with all his impulsive mastery of men, he had the magnetic charm of attracting loyal co-operation and energetic contributory enterprise wherever he led.

Friend of Workingman and Great Engineer

By Robert Thurston Kent

In 1906, when Frederick Winslow Taylor's paper "The Art of Cutting Metals" was published, it was characterized in an editorial in *The Iron Trade Review* as the most important contribution ever made to engineering literature. Since that time, there seems to have been but one reason for changing this statement. This one exception is Taylor's paper "Shop Management" published three years previous, but whose importance was not realized at the time. It was no mean achievement to complete an investigation, the results of which rendered obsolete, on the day it was completed, every machine tool in the world; and this is what Taylor's investigation into the art of cutting metals, and the resulting development of high speed steel did.

But great as was this achievement, it pales into comparative insignificance alongside of the work outlined in the paper "Shop Management," which has been the foundation of the most important revolution which has come into industrial life in America. Nothing since the introduction of the factory system of manufacturing can compare with the work which Taylor has done in developing the art and science of management. "The Art of Cutting Metals," wonderful as it seemed at the time and wonderful as it is today, was but a mere incident in this greater work which Taylor has done and which has led to his being called the "Father of Scientific Management."

Those who have had the privilege of being intimate with the man, were impressed more and more at every meeting with him, with the wonderful qualities of his mind, and breadth of his knowledge and the clear insight which he had into the problems which had to do with scientific investigations in many different fields. He possessed at one and the same time, the diverse qualities which ordinarily can be obtained only in several different men acting together, and which are necessary for the thorough manager and finished investigator. In addition, he possessed an indomitable perseverance, a bull-dog tenacity, which enabled him to push on through the most adverse circumstances and under the most discouraging conditions, until the object which he had clearly in mind for 26 years was attained; namely, the establishment of a science of management, which would insure to the workman a just compensation, and to the employer an adequate return from labor for the wages paid.

The magnitude of this task can be realized when it is known that it involved investigations into the domains of engineering, of metallurgy, of physiology, of psychology, of accounting and other diverse sciences, all of which enter into the complex life of the every-day industrial plant. And it is a matter of astonishment that Taylor could make himself a master of all these sciences as the necessity for using them arose in his work.

It is given to few men to found a new science. It is given to still fewer of these to live to see the science which they have founded established complete in its all fundamental details. Yet such has been the thor-

Substituted Knowledge for Opinion

By H. L. Gantt

Frederick Winslow Taylor's great contribution to the world's work was to substitute knowledge of human activities for opinion as a basis of action.

His insistence that all industrial questions could be best answered by a scientific investigation was at first scoffed at by many of our industrial leaders, and it was nearly 20 years before he got much support. Now, however, at the end of 35 years his persistence is bearing fruit so rapidly that the whole industrial world is undergoing a revolution due to his ideas.

His death cuts short the activities of a man who has had the welfare of his fellow men at heart, and who has spent much of his life in trying to establish a basis on which the relations between employer and employe can be made mutually satisfactory.

When he began his work, all such relations were established by opinions. Today there are few industries in which fact has not supplanted many opinions.

He had the feeling that waste was a crime, and that efficiency in work was a duty not only to ourselves and to our employers, but to the community at large.

His name will live as that of a man who could rise above individual cases, and grasp general laws that would make for the happiness and prosperity of all.

oughness of Taylor, that although he has been removed from his work at a comparatively early age, he has lived to see the science of management established complete in all its essentials. There are now only the loose ends to be gathered up in order to round out the greatest work of one of the greatest engineers the world has ever seen.

Despite the fact that his work is complete, nevertheless the engineering profession and the country have suffered an irreparable loss in the death of Frederick Taylor. The value of the advice of a man like him to those who are carrying on the work that he founded is something that cannot be measured in dollars and cents. Those who are left will miss the stimulus of his enthusiasm, the aid of his clear insight into the perplexing problems which they had to solve, the ability to pick out the vital question in their investigations. Those, who through misguided or selfish motives have regarded him as their natural antagonist—the labor leaders—will come in time to see that he was the best friend that the workingman of this country ever had. For the ideals of Taylor did not aim at the supression of the initiative of the workman, did not aim to speed him up to a point where his health was impaired. On the contrary, Taylor's ideal was the same as that of the working man; namely, the highest possible wage and the shortest possible hours.

The good that men do lives after them. The work of Taylor will live long after he and those that labored with him have passed from the memory of living man. He has set a mark upon the industries of the United States which will never be effaced.

Fame Will Grow as Years Pass

By Harrington Emerson

We all hoped that Frederick W. Taylor, the great leader, would be with us to inspire and to guide for many years.

We were unprepared for his sudden death. It is difficult to express adequate appreciation of or to sum up a life so distinguished.

Mr. Taylor was the creator of scientific management in machine shops. His education (including schooling in France as a boy, where he absorbed the French passion for logic) peculiarly fitted him for the task he took up.

His great discovery was that of high-speed steel, which has revolutionized machine shop practice to the same degree that railroads have revolutionized transportation.

But this discovery was only a by-product of his universal method of possessing complete records, fastening on the exceptionally good, ascertaining the cause and making permanently standard what had been accidental.

One of Mr. Taylor's most marked characteristics was his unwillingness to waive a standard, when it had once been reliably determined. Everything else had to yield, but not the standard.

Another of Mr. Taylor's most noble traits was his recognition of the value of co-operation and publicity. He felt that if thousands could be encouraged to work on right methods and on right principles, the millenium would come the sooner. Therefore he devoted the last leisure years of his most successful life to disinterested teaching and promulgation of his beliefs.

As a creator of new conceptions and of new standards, he ranks with the greatest in a field peculiarly American and his fame will grow as the years pass.

He was an immense stimulus to me. From the time I first met him in 1900 until the present, I was fortunate in seeing him frequently and I mourn that he has been taken from us in his prime.

Home Life Was Delightful

By Worcester R. Warner

The passing of Frederick W. Taylor will cause profound sorrow to thousands of workers, engineers and manufacturers.

His fame as a pioneer in introducing the so-called 'scientific management" in many lines of industry extended not only all over this country, but throughout Europe as well. One of his strongest points, however, was not generally known, and that is his delightful home and family life. It was there that I knew him best. His beautiful home in Germantown, made specially interesting by his own mechanical genius as well as the artistic taste of Mrs. Taylor, together with the genuine hospitality with which their friends were received, will not be forgotten by those who were fortunate enough to be guests of the Taylor family.

It has been my pleasure to meet him not only in his own home, but on summer journeys and in European travel, and always he was the elegant gentleman and kind friend.

He was free to converse on his specialty, but not for profit, for his advice, his lectures and his labor along these lines were for the general good rather than any selfish purpose.

His large circle of friends will retain the pleasantest memories of Frederick W. Taylor, and all will sympathize deeply with his wife and family.

To Cleveland

Westinghouse Foundry Equipment Will Be Moved

Pittsburgh, March 24. (By wire.)—Upon the absorption of the Westinghouse Machine Co. by the Westinghouse Electric & Mfg. Co., the latter company will dismantle its foundry on the Northside, Pittsburgh, and will move equipment to its foundry at Cleveland. The Cleveland shop, which will be increased in capacity, will be used for light work. Heavy castings for the merged interests will be made at the foundry of the Machine company at Trafford City, Pa.

While no official information is given out, it is reported that contracts for extensions to the Cleveland foundry will be let at an early date.

Small Lots

Of Pig Iron Sold for Export to England in Pittsburgh

Pittsburgh, March 24. (By wire.)—Numerous inquiries for pig iron of all grades for export have come into this market the last fortnight and several small lots have been sold. Sales do not involve heavy tonnages, according to dealers in close touch with the situation. Great Britain has been figuring for iron, and inquiries have been received from continental countries, but many of the inquiries are indefinite. The difficulty of obtaining bottoms seems to minimize activity for export.

Taylor-Wharton Election

The Taylor-Wharton Iron & Steel Co., High Bridge, N. J., at its annual meeting elected the following directors: Henry J. Cochran, James Imbrie, R. Burnham Moffat, V. G. Simkhovitch and John F. Wallace, all of New York City; Frank C. Roberts and William Selfridge, Philadelphia; Robert Hobson, Hamilton, Ont.; Dr. Henry Marion Howe, Bedford Hills, N. Y.; Knox Taylor, High Bridge, N. J.

Officers elected are: President, Knox Taylor; vice presidents, Victor Angerer and Dr. Henry M. Howe; secretary and treasurer, W. A. Ingram; assistant secretary and assistant treasurer, L. N. Aller.

How an Axle Failed in Service

Study of a Passenger Train Wreck Caused by an Axle Breaking as a Result of Surface Defects

A PASSENGER train on the Baltimore & Ohio railroad was derailed Sept. 19, 1914, near Woodlyn, Pa. The wreck resulted in the injury of 34 passengers, three Pullman employes and one employe of the railroad. It was caused, it is stated in a report issued by H. W. Belnap, chief, division of safety, interstate commerce commission, by the breakage of the forward axle of the locomotive tender. The speed at the time of derailment was 57 miles per hour.

Description of Accident

After derailment the tender wheels ran along on the ties until they reached the western end of the north passing track. At this point the frog was torn out and the entire train derailed. About 150 feet beyond this point is a double-track, single-span, trussed bridge 167 feet 4 inches in length. The locomotive and first five cars passed over the bridge in safety, the locomotive coming to a stop 710 feet beyond the western end of the bridge with the derailed tender coupled to it. About 25 feet north of the locomotive were the first four cars of the train, upright on the ties. The fifth car turned over to the right immediately after crossing the bridge and came to rest with its roof against a telegraph pole, at the top of a 25-foot embankment. The sixth car, the all-steel Pullman car Rachita, swerved to the right enough to strike the end post of the right-hand truss of the bridge, after which it plunged to the track below, a distance of about 25 feet. The second Pullman sleeping car stopped with its forward end projecting over the bridge abutment and was also leaning to the right against a telegraph pole. The last car in the train, a parlor car, was also derailed, but remained upright at the top of the embankment, immediately behind the second sleeping car. The damage caused to the bridge by the sleeping car Rachita caused its collapse. Fig. 1 is a general view of the accident, looking in the direction in which the train was moving.

The fractured axle represents one of the largest in common use for tender trucks. It was furnished under the specifications of the Baltimore & Ohio Railroad Co., which call for the dimensions given in Fig. 9.

Axle Specifications

The specifications state that axles shall be made of steel, the desired composition of which is as follows:

	Per cent.
Carbon	0.45
Manganese, not above	0.50
Silicon	0.05
Phosphorus, not above	0.04
Sulphur, not above	0.04

Axles will be considered as having failed chemically and will be rejected if the analysis shows the constituents to be outside the following limits:

	Per cent.
Carbon	below 0.35 or above 0.55
Manganese	above 0.50
Phosphorus	above 0.06
Sulphur	above 0.05

Axles of this size are required to stand a drop test of seven blows of a 1,640-pound tup, dropped from a height of 52 feet, the deflection under the first blow not to exceed 4¼ inches. During the test they are to rest upon supports 3 feet apart, the tup striking the axle midway its length. The axle to be turned, that is, rotated 180 degrees, after the first and third blows and when required after the fifth.

Weight on Axle

The marks on the axle indicated that the wheels were pressed on in the month of July, 1913, and that a pressure of 100 tons was used for the wheel at the fractured end and 80 tons for the opposite wheel.

Rolled steel wheels were used. The wheel on the fractured end of the axle was branded "ct S ct 6 28 13 673 15542", that on the other end, "6 29 13 428". The total weight of the tender under which this axle was used was 165,000 pounds, an average load of 20,625 pounds per wheel. The bearing surfaces of the journals were in good condition, showing no wear of consequence, the wheels also being in

FIG. 1—GENERAL VIEW OF DERAILMENT DUE TO FAILED AXLE

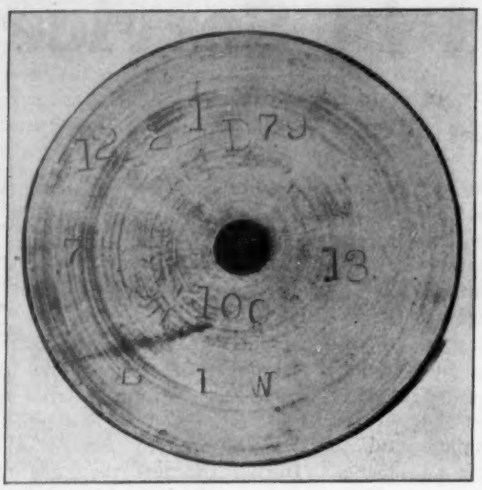


FIG. 2 — MARKS STAMPED ON END OF FRACTURED JOURNAL INDICATING DATE WHEEL WAS PRESSED ON AXLE AND PRESSURE IN TONS USED

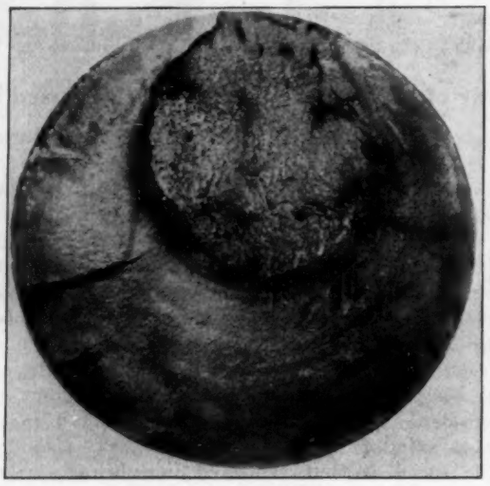


FIG. 3—END VIEW OF FRACTURED AXLE, SHOWING CHARACTER OF SURFACE OF PROGRESSIVE FRACTURE. 3 INCHES OF METAL REMAINED INTACT UP TO TIME OF FINAL FRACTURE

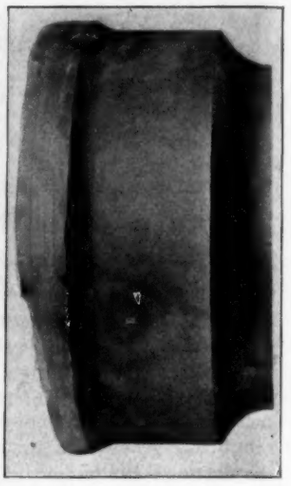


FIG. 4—SIDE VIEW FRACTURED AXLE AT WHEEL FIT AND DUST GUARD, SHOWING CIRCUMFERENTIAL SCORING ON WHEEL FIT WHICH PLANE OF FRACTURE FOLLOWED OVER PART OF ITS COURSE

good order. The wheel at the intact end shows a little more flange wear than its mate, but each was in a satisfactory condition.

An examination was made of the fractured axle for concentricity in running, with wheels still in place. For this purpose it was centered in a lathe and there rotated. It was found to be substantially in normal condition, notwithstanding the vicissitudes through which it had passed at the time of derailment. No contributory cause leading to its failure was revealed at this time.

The wheels were next pressed off the axle. The one at the fractured end required a force of 375 tons to remove it; that on the intact end required 145 tons pressure. The surfaces of the axle at the wheel fits were now exposed to view. That on the intact end was in good condition and presented a normal appearance. The surface at the fractured end, however, was characterized by the presence of a considerable number of marks or serrations made by some blunt-edged tool, which, as a group, covered about two-thirds of the circumference. They were located on the side of the axle which first ruptured and were symmetrical with that side. The significance of these serrations in respect to their indicating a cause for the failure of the axle and their probable origin will be referred to in a later part of this report. The dismantled axle was subjected to a drop test. It endured the seven prescribed blows without fracture. The deflection caused by the first blow was 1.8 inches. An eighth blow was struck to straighten the axle. Two longitudinal seams were developed along the length of the axle, one near the middle and one near the intact end. No particular significance is attached to the development of these seams in respect to influencing

Table I.

CHEMICAL ANALYSES OF FRACTURED AXLE

Location. Fractured end of axle:	Carbon. Per cent.	Sulphur. Per cent.	Phosphorus. Per cent.	Manganese. Per cent.
Near circumference	0.39	0.039	0.026	0.45
One-quarter below surface	0.37	0.038	0.023	0.47
Center of section	0.38	0.039	0.025	0.46
Intact end of axle:				
Near circumference	0.40	0.037	0.025	0.44
One-quarter below surface	0.37	0.040	0.025	0.45
Center of section	0.39	0.039	0.024	0.46

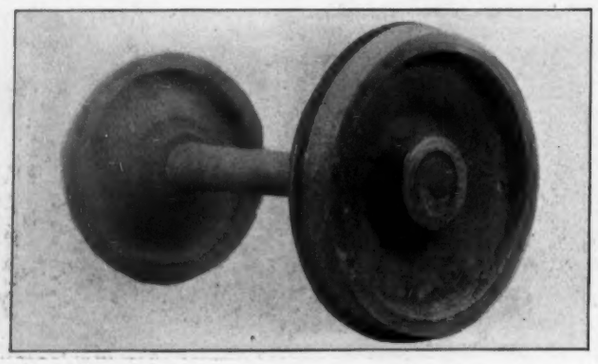


FIG. 5—TRUCK WHEELS SHOWING FRACTURED SURFACE OF AXLE JUST BELOW FACE OF HUB

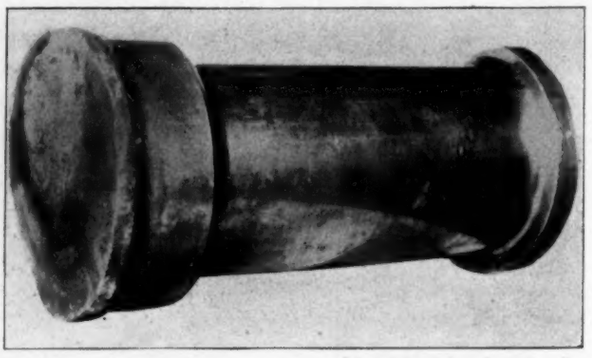


FIG. 6—PORTION OF AXLE DETACHED BY FRACTURE

the failure of the axle at the time of derailment. They represented the development of seams which were in the forging but of a kind which service conditions would not be expected to develop.

The axles were next cut up for metallographic examination, chemical analysis and physical tests. Chips for chemical analysis were taken from different parts of the cross section, near the finished surface or circumference of the axle, one quarter below the surface diametrically, and at the center of the section. Two sets of chips were taken, one representing the metal in the vicinity of the place of rupture, the other the opposite end of the axle. The results of the chemical analyses are given in Table I.

Hardness tests by means of the scleroscope were made on the surface of the wheel fit, near the place of fracture, and on two cross sections in the same vicinity. On the surface of the wheel fit, near the place of fracture, the hardness ranged from 31 to 44. The harder metal was on the side of the axle first to rupture. On the two cross sections the hardness ranged from 23 to 28. The higher values at the surface of the wheel fit are attributed to mechanical work having been done on that surface in pressing on the wheel, or incidental treatment, rather than to any material difference in the composition of the steel. The microstructure of the steel did not indicate a difference in hardness due to composition at the surface of the axle. The metallographic examination, taken at four places on the circumference, 90 degrees apart, showed identical structure throughout.

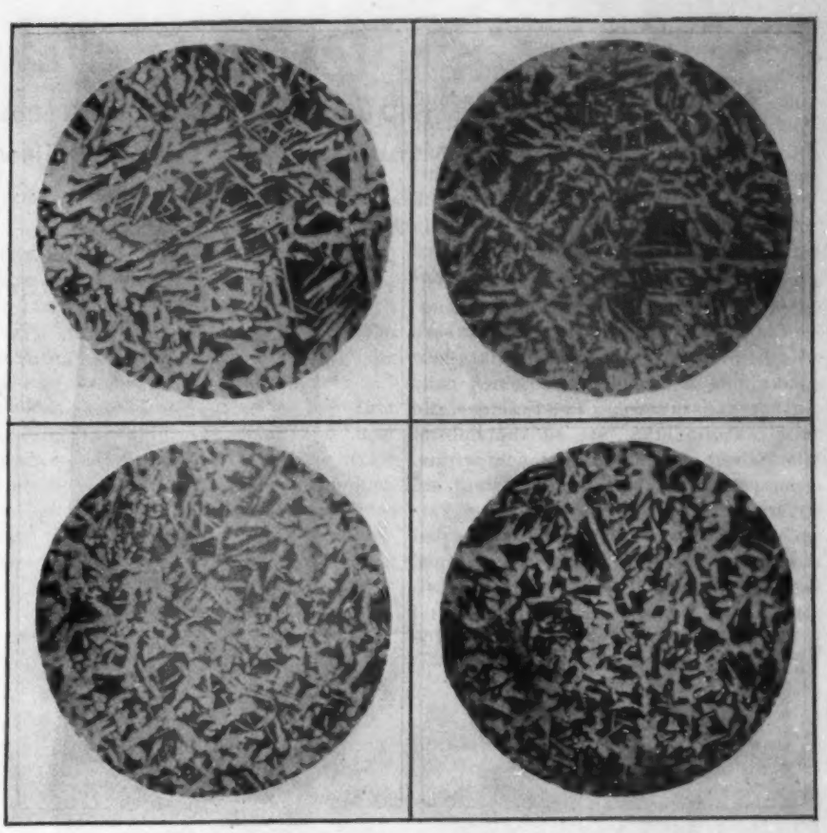


FIG. 7—MICROSTRUCTURE OF FRACTURED AXLE NEAR CIRCUMFERENCE AT WHEEL FIT AND NEAR PLACE OF FRACTURE. SPECIMENS TAKEN 90 DEGREES APART. MAGNIFICATION, 50 DIAMETERS

Table II.

RESULTS OF TENSILE TESTS ON FAILED AXLE

Location.	Tensile strength, per sq. in.	Elongation.	Contraction of area.
	Pounds.	Per cent.	Per cent.
Longitudinal specimens, natural state of forging:			
Near circumference	75,800	29.0	42.3
One quarter below surface	75,000	29.0	44.3
Center of section	71,200	28.0	40.2
Longitudinal specimens, annealed:			
Near circumference	72,800	31.5	49.2
One quarter below surface	69,500	33.0	51.8
Center of section	68,700	30.0	47.6
Crosswise specimens, natural state of forging:			
Diametrical and on chords	69,300	18.0	18.4
	67,130	15.0	14.8
	70,900	20.0	21.4

Tensile tests were made on the metal of the section covered by the wheel fit near the place of fracture. The tests represented the metal, in a longitudinal direction, near the circumference, one-quarter below the surface, and at the center of the axle. Specimens were taken out in duplicate, one set being tested in the natural state of the metal in the forging and one set after the metal was annealed. Three additional specimens were taken from the axle near the middle of its length, in a crosswise direction. The results of the tensile tests are given in Table II. The specimens were 0.50 inch diameter by 2 inches long.

The elastic limits of the longitudinal, unannealed specimens were in the vicinity of 45,000 pounds per square inch, which dropped to 37,000 pounds per square inch in the annealed metal. In a crosswise direction the elastic limits were about 30,000 pounds per square inch. The fractures of the longitudinal specimens were fine silky, those of the crosswise specimens lamellar.

The results of the examination of the metal showed a grade of steel had been used which under normal conditions should have enabled the axle to sustain the loads of the tender, which under static conditions were not high. Assuming a load of 20,000 pounds carried by each journal, with center of effort at the middle of the length of the journal, then the bending stress at the inner end would be only 5,186 pounds per square inch. At the inner end of the dust guard section the computed stress would be 4,142 pounds per square inch, while in the vicinity of the actual place of rupture, at the wheel seat, the static stress would be somewhat less than 4,000 pounds per square inch. These are recognized as moderate bending stresses which if not exceeded the axle should carry with safety. The fracture of this and other axles indicates, however, that occasional loads are received greatly in excess of the static loads, the severity of which is accountable for the ultimate failure of axles.

This axle was used with 36-inch

wheels. It would, therefore, make about 560 rotations per mile, and the total number of rotations for its mileage of 84,649 miles would be, in round numbers, 47,400,000. Under a constant bending stress as low as 5,186 pounds per square inch the effect of this number of repetitions should not affect the integrity of the axle. In fact, the life of the axle under a load of this magnitude should be practically of unlimited duration.

This axle fractured at a place where the bending stresses were not at their maximum, a circumstance which calls for special inquiry. The fracture did not occur at the face of the hub of the wheel, but at a distance within, ranging from three-sixteenths of an inch to seven-sixteenths. From its position it was effectually concealed by the metal of the hub, its presence not admitting of discovery prior to the complete separation of the metal and the failure of the axle. The type of fracture, however, was a common one, and known as a detailed or progressive fracture, a type of fracture which results from a number of repetitions of load. Fractures of this kind are unaccompanied by the development of ductility which is displayed in the usual tests of the metal.

The fracture of this axle started on one side of its cross section, thence extending toward the center. At the time of final rupture only about one-quarter of the cross section remained intact. The final portion was an eccentric section some 3 inches in diameter. The fractured surface presented the usual characteristics witnessed in repeated stress fractures. The earlier fractured portions were hammered smooth by the longitudinal compressive component, which acted on the axle up to the time of final fracture. The portion which failed last had a

FIG. 8 — SIDE VIEW OF FRACTURED AXLE AT WHEEL FIT, SHOWING SERRATIONS ON SURFACE ADJACENT TO FRACTURE

silky appearance, but was somewhat battered by blows received at the time of the derailment. The fiber stresses in this part of the axle certainly were greatly augmented before final rupture was reached. They must have been increased several fold at the time that the axle was reduced to an effective diameter of 3 inches. Failures of this kind have furnished evidence upon the wide fluctuations of stresses which are received in the track, since there have been instances in which axles, partially ruptured, have been discovered carrying normal loads on diameters of sound metal very much reduced over their original dimensions. Such evidence, resting upon a number of examples, leads to the deduction that wide fluctuations of loads are generally encountered in the track and must be provided for in establishing the dimensions of axles. Practically this is a matter not easily fixed.

There are places in which, by reason of the difficulties which surround the determination of the actual working stresses, the problem of providing a proper section, is one of peculiar obscurity. Axles are examples in which it is essential to provide adequate strength to resist loads which in a strict sense are indeterminate. For this reason the failure of an axle of this kind is matter of deep concern, unless some unusual and specific cause for its fracture can be found.

It is believed that an exceptional condition existed in the case of this axle which affected its durability and led to its premature failure. It was found in a well-defined circumferential mark scored upon the surface of the wheel fit, which the plane of rupture followed over a considerable portion of its course. This scored line appeared to have located in incipient place of rupture. In appearance it resembled the effect of the cutting edge of some hard body rather than the mark of an ordinary lathe tool used in the finishing cut on the axle. If not made by a lathe tool, it must have been made by some hard body

(*Continued on page* 642b.)

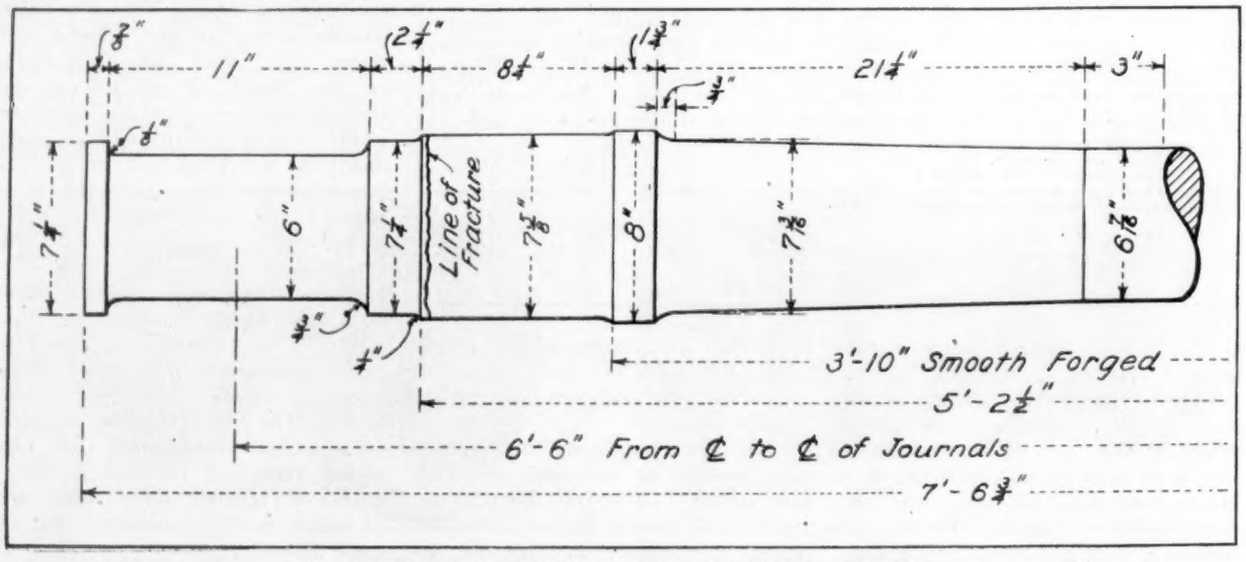


FIG. 9—SKETCH SHOWING DIMENSIONS OF FRACTURED AXLE

Steel for Steering Knuckles

How the Microscope is Used to Determine the Correct Forging, Annealing and Drawing Temperatures

BY E F LAKE

THAT microscopical examination is a great aid, in a commercial way, in determining the efficiency of parts that are manufactured of steel, is well illustrated by an investigation that was conducted recently by the Studebaker Corporation in its laboratory in Detroit. This particular investigation was undertaken to find what effect the various methods of working and heat-treating have upon the steel that forms the steering knuckles which go into automobiles. The steering knuckle is one of the most important parts that enter into the construction of a motor car. When it breaks, the driver loses control of the machine, which is then liable to run into the ditch or into obstructions along the road and turn turtle or do other dangerous stunts. This has been the cause of many serious, as well as fatal accidents to the occupants of automobiles. The investigation led to the adoption of means for overcoming any bad effects upon the metal. The steering knuckles are located on the front axle, below the springs, and hence they receive many rapidly repeated vibrational strains. They come from the car traveling over the uneven surfaces of the road which cause the axle to continually bob up and down. The knuckles also receive many hard jars from the wheels striking stones or holes in the road and have to resist nearly all the strains of the steering mechanism when turning the wheels to the right or to the left.

It is hardly necessary to say that at the present time only the best grades of steel are used in the axles and steering parts of an automobile. Many automobile makers only use such high grade alloys as nickel-chrome and nickel steels, or the steels which are treated with titanium or vanadium. The steering knuckle is customarily forged in order to produce as dense a grain to the metal as can be given and thus bring out all of its inherent strength. Fig. 1 shows how the steel looked close to the outer edge of one of these forgings, just as it came from the shop. This was polished, but not etched and was magnified 120 diameters, which is the magnification for all the other views shown. In Fig. 2 will be seen a view of the steel near the center of the forging.

What the White Streaks Show

The white streaks show the effect of the hammer blows on the metal and they well illustrate the internal strains that are set up in steels by this kind of working. Fatigue tests have shown that microscopical cracks quickly develop along the lines where the white streaks join the dark sections and these soon grow into cracks that produce breakages. Fig. 2 shows that the central portion had a coarser structure than the metal at the outer edge and hence it would not withstand as many vibrational strains before a breakage occurred, or as severe tensile, torsional, compressive or bending strains. This showed that the effect from the hammer blows did not penetrate clear to the center. It can be corrected by increasing the power of the hammer blows or by heating the steel to a higher temperature before it is forged, or by both.

The high heat to which steel is subjected before it is forged, produces a coarse crystalline structure that is very similar to that of cast steel. The forging hammer breaks up this crystalline formation, compressing and densifying the grain, thereby increasing the cohesive forces that bind the molecules of the mass together. Rolling, pressing and cold-drawing will do the same thing and thus, worked steels are much tougher and stronger than cast steels. Internal strains are nearly always set up by such working,

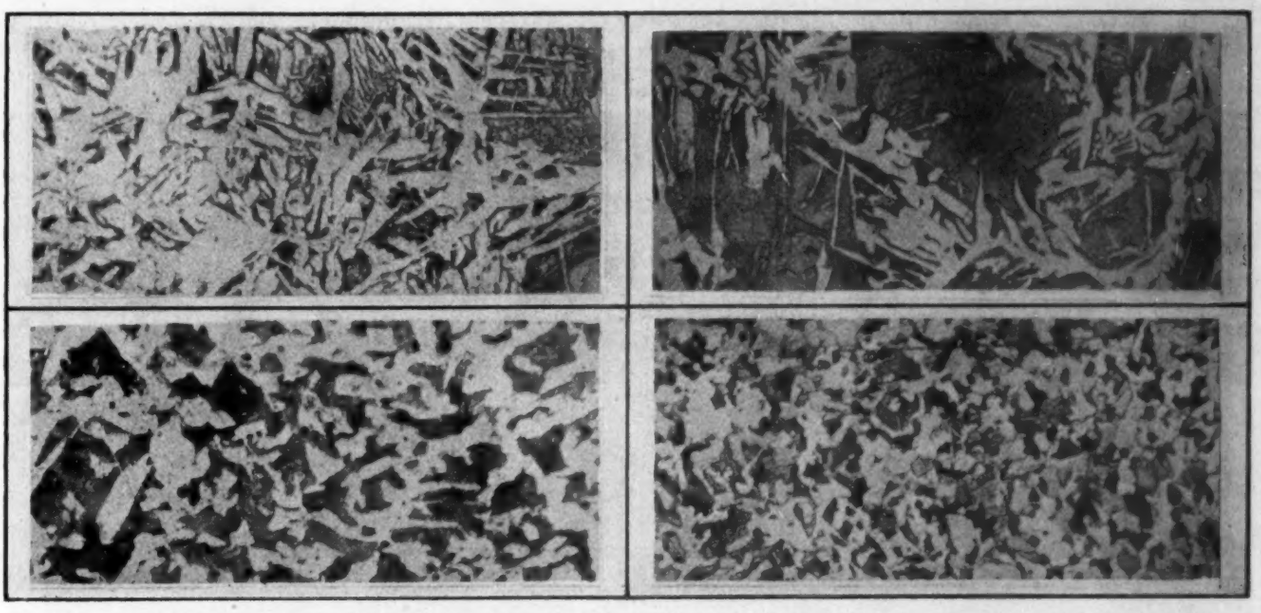


FIG. 1—STRUCTURE AT OUTER EDGE OF STEERING KNUCKLE AFTER FORGING

FIG. 2—CENTRAL PORTION OF STEERING KNUCKLE AFTER FORGING

FIG. 3—ANNEALING TEMPERATURE TOO HIGH

FIG. 4—STEEL ANNEALED AT CORRECT TEMPERATURE

but they can be removed by correctly heat-treating the metal afterward.

One often hears the statement that any vibration strains, to which steel may be subjected when in use, will cause the metal to crystallize and that this crystallization is the cause of breakages. Such is not the fact, however as crystallization in steel is only caused from heating it to a temperature that is above the correct one for hardening. As steel is being heated, it reaches a point at which a complete change takes place in the grain structure. Then the grain is as fine and dense as it can be made in that particular grade of steel. Each degree to which the steel is heated above this transformation point gradually increases the coarseness of the grain. Eventually it reaches the coarse crystalline structure that is found in cast steel. When a crystalline structure is seen where a breakage has occurred it can only mean that the heat treatment was very poor, or if the steel was not heat-treated, it would mean that it was overheated while being worked.

How Steel Fails in Service

When steel is subjected to vibrational or other strains, it is only a question of time when it will reach the end of its life and a breakage occurs. The grain is never coarsened by this action, however, and a fine grain steel will stand much more severe strains than one which is coarse-grained. In time, however, these strains will start the grain crystals to sliding past one another on a line where the cohesive force is the weakest. When this sliding has reached a point that entirely destroys the cohesive force on that line, a breakage will occur in the metal. This sliding of the grain crystals past one another usually follows such lines as are shown by the places where the white streaks join the dark-colored sections. Thus it will be seen that it is much easier for this sliding to follow the lines of the coarse-grained steel in Figs. 1 and 2 than it would be to follow the lines of the fine-grained steel in Fig. 7. This latter is a view of the steel after it had been correctly heat-treated for a steering knuckle.

Rules for Annealing

The first thing that should be done to the steel after it has been forged, rolled or otherwise worked is to thoroughly anneal it to remove any internal strains such as are shown in Figs. 1 and 2. There are three fundamental rules that should be followed in annealing all steels and these are:

First.—The steel must not be heated to a temperature above the highest transformation point of the steel, but as close to this point as possible.

Second.—This temperature must be retained long enough to allow the entire piece to reach an even temperature, but it should not be prolonged beyond that.

Third.—The rate of cooling must be a rate that is slow enough to prevent any hardening from taking place, not even superficial hardening. Fig. 3 shows the steel of an annealed steering knuckle when the first rule was not followed. In this case the temperature was raised considerably above the transformation point, while the metal was being subjected to the annealing heat and consequently the grain was made much coarser than it should be. No method of cooling will reduce the size of the grain structure, and therefore it stays at the size that was produced by the highest temperature to which the metal was heated. The annealing heat was kept at the correct temperature while the sample shown by Fig. 4 was being annealed. The difference in the grain structure of the two specimens can plainly be seen. If the annealing temperature had not been raised up to the transformation point, the grain structure would change very little, and hence the steel would retain the appearance shown by Figs. 1 and 2 and the internal strains would not be removed.

The steel's elastic limit and resistance to fatigue will be reduced in the same proportion that the grain structure is increased in size by overheating. Thus the microscope gives a clear perception of the alterations that take place in the physical properties. When the hardening temperature of steel is raised 50 degrees too high, the steel will lose 15 per cent of its elastic limit and resistance to fatigue. A temperature, before quenching, that is 100 degrees above the transformation point will make the steel lose 30 per cent of its elastic limit and longevity.

After annealing, the forgings are sent through the machine shop to have any machine work done that may be necessary. The steering knuckles are then hardened. In Fig. 5 is shown one after it has been hardened at the correct temperature. When the steel undergoes the change in grain structure which takes place when its temperature has been raised to the highest transformation point, the constituent called martensite is produced. This martensite is preserved when the steel is suddenly cooled down from that temperature, or quenched, and that is what is seen in Fig. 5.

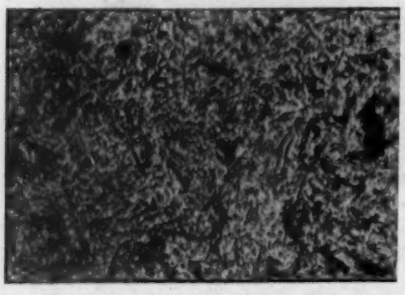


FIG. 5 — STEEL HARDENED AT CORRECT TEMPERATURE, SHOWING MARTENSITE STRUCTURE

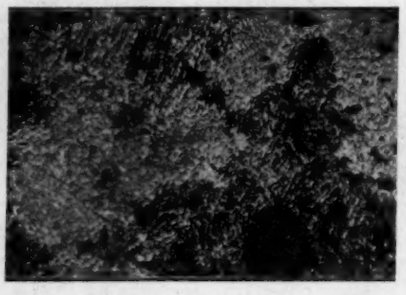


FIG. 6—MARTENSITE AND TROOSTITE IN STEEL DRAWN AT 300 DEGREES CENT.

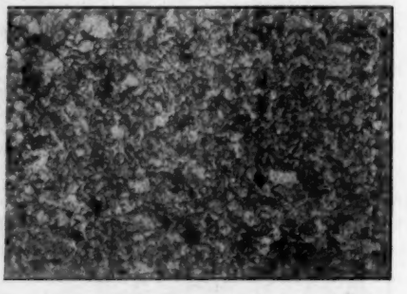


FIG. 7 — SORBITE STRUCTURE OF STEERING KNUCKLE DRAWN AT 600 DEGREES CENT.

Martensite Structure

If the steel was allowed to cool slowly, however, the martensite would disappear and only the pearlite and ferrite would be seen, as in the annealed steels shown in Figs. 3 and 4. If it were not heated up to the transformation point before quenching the martensite would not appear and only the pearlite and ferrite would show under the microscope. It will be seen that the martensite is quite fine grained in Fig. 5, but, if the temperature had been raised above the transformation point before the steel was quenched the martensite would show a grain that was coarsened in proportion to the number of degrees the temperature had been raised.

Hardening greatly increases the

(*Continued on page* 614.)

Improved Laboratory Furnace

Description of Electric Furnace and Rheostat for Steel Works Laboratories—May be Constructed Cheaply

BY CHARLES M JOHNSON

IN MAY, 1908, the write introduced a new electrically heated carbon combustion furnace. The loss of heat by radiation was prevented by means of a sheet iron cylinder filled with powdered magnesia. An improvement over the original furnace is shown at 4 in the accompanying illustration. It is of the most simple construction and consists of only three parts, a heating element, a split muffle and the supporting frame. The muffle feature does away with all the nuisance of the powder insulation and the screwing on of ends. The muffle composition is largely infusorial earth and saves considerable current on account of the great heat insulating properties of such an envelope.

The furnace heats from cold to 1,000 degrees Cent. in 15 to 20 minutes. The apparatus is easily kept clean and bright looking. The writer has built eight for his laboratory which he now has in use and is planning to change four more of the old style. The first one put into service has now been running over four months continuously, and another one has three months' run to its credit. Both furnaces are on direct current at 220 volts. These furnaces can be built for $10, or less, including labor and all materials. The split muffle can be had at $2 and any blacksmith can make the legs in two hours. Particular care should be given to the heating element. For a 220-volt circuit, the writer uses 85 to 90 feet of nickel chrome wire. This wire should not contain over 1 per cent of iron and, in all, not over 3 per cent of elements other than nickel and chromium. Nickel chrome wire high in iron is brittle, breaking in coiling, and oxidizing more rapidly at high temperatures.

For 110 volts, of course, just half the length of wire mentioned above should be used. The wire is coiled on a rod 3/16-inch in diameter by means of a small motor or by fastening the rod in a lathe. Also it can be bought coiled to exact length. The turns of the coil are separated about a millimeter from each other. The coil is wrapped, spirally, on a smooth wooden or metal form of the diameter desired for the heating chamber. Before putting on the wire, the form is covered with one or two layers of glazed finish wrapping paper. The wire having been put on in an even spiral, it is tied at the ends with asbestos cord. It is next covered, completely and evenly, with a blanket of alundum cement. The dry cement should be just thoroughly moistened with water. If the cement is made too wet it will crack badly in the drying.

After the cement is thoroughly dry, the paper is twisted to a smaller diameter at the ends and the form is drawn out carefully. The heating element now is ready for use. The writer uses No. 20 gage wire (0.032 inch in diameter). A pound of this wire should make enough coils for four elements.

In order to control the fluctuations of the current and to prevent the temperature from rising above the desired one, a rheostat of some kind is indispensable for all types of wire wound furnaces. The author had so much trouble in making repairs to various rheostats that he decided to design a rheostat that could be easily

IMPROVED LABORATORY FURNACE AND RHEOSTAT

Portions of a paper read before the Pittsburgh section of the American Chemical Society. The author, C. M. Johnson, is chief chemist, Park works, Crucible Steel Co. of America, Pittsburgh.

repaired and also cheaply constructed. Such a controller should be of such capacity that it will not become highly overheated when used on any furnace ordinarily required in an iron and steel laboratory. A further object is to have the design such that the rheostat will not occupy much space on the work table. The design covering the foregoing points is shown in the background in the accompanying illustration. It consists of a piece of transite board (hard asbestos). ½ x 15 x 16 inches, costing 65 cents. The board has 21 contacts made with small brass bolts with double nuts. The resistor for a 220-volt circuit is 90 feet of 24 per cent nickel-steel wire costing 32 cents. The wire is strung between the double nuts in the manner which is shown in the picture.

As the steel handle is passed over the contacts, it puts into the circuit a greater or less number of lengths of the wire, thus lowering or raising the temperature of the furnace which is connected in series with the rheostat. The connector plugs, brass terminals, posts and nuts add about $1.50 more to the cost. The time can be figured at about $7 and the steel arm should add 50 cents to the total.

This type of rheostat will occupy but 6 inches of the width of the laboratory table and can be, for this reason, placed behind the furnace, or to one side, and out of the way, and yet always in view. It presents a clean, bright and neat appearance. Two of these rheostats can be bolted together, back to back, thus getting a double rheostat.

This rheostat is used in the laboratory of the Park works of the Crucible Steel Co. of America, both on the small furnace just described and also on a larger rectangular muffle furnace which requires 14 amperes at 220 volts to heat it to temperatures around 1,000 degrees Cent.

The large furnace is large enough to receive porcelain dishes, crucibles and pieces of steel for experimental heat treatment. Its heating chamber is 12 x 7 x 5 inches. It is built on the same plan as the carbon combustion furnace. It consists of a solid heat insulator, a rectangular heating element and a support. A door, of course, is required for such a furnace. The door is bolted on the metallic supporting frame. It is hinged to swing horizontally and is lined with a refractory brick. Such a furnace, I believe, gives a more uniform heat than one insulated with magnesia oxide and there is no powder to sift out.

Steel for Steering Knuckles

(*Continued from page 612.*)

tensile strength and elastic limit of steels, and this increase is more pronounced in the special alloys than in the carbon steels. A steering knuckle that was made from a nickel-chrome steel gave an elastic limit of 61,000 pounds per square inch, when in the annealed state, and this was increased to 274,000 pounds when it had been hardened at the correct temperature. When this same steel was drawn enough to give it the proper toughness for withstanding vibrational or other strains, it still had an elastic limit of 226,000 pounds. Likewise nickel steel, with an elastic limit of 64,000 pounds in the annealed state, was raised to 224,000 pounds by hardening and 171,000 pounds of this was retained after it had been drawn at the correct temperature.

These figures would be reduced from 15 to 30 per cent by raising the hardening temperature some 50 or 100 degrees above the transformation point, and the resistance to fatigue would be reduced in like proportions. Thus this investigation showed the Studebaker Corporation the necessity of having temperature controlled furnaces in which to heat-treat steel, and of keeping the temperature, throughout an all-day run, within 10 degrees of the correct point. Such are the practical results which come from microscopical examinations. By equipping furnaces with apparatus that would properly control the temperatures, the company was enabled to get more accurate results and do it with labor that was less skilled.

The correct drawing temperature is just as important as the correct annealing or hardening temperature, although there is no danger of coarsening or crystallizing the grain structure with this operation. After the steel has been hardened it is too brittle to use for any part of a machine. This brittleness is reduced and the toughness increased by reheating the steel. The degree of temperature to which it is reheated depends upon the toughness or hardness that is required. For instance, steel is reheated to between 200 and 300 degrees Cent. for cutting tools. Parts that are subjected to rapidly repeated vibration, however, might require a drawing temperature of 600 degrees Cent.

When steel is reheated for the drawing operation the martensite is rapidly replaced by another constituent called troostite, which can be seen under the microscope. In most grades of steel the martensite has entirely disappeared, since it is replaced by the troostitic formation when the drawing temperature reaches something like 400 degrees Cent. As the temperature is raised above this point the troostite gradually disappears and sorbite takes its place. The troostite has entirely disappeared and only sorbite will be seen at a drawing temperature of some 600 degrees. After this temperature is past, the pearlite of annealing steel begins to replace the sorbite.

In Fig. 6 is shown a steering knuckle steel after it had been drawn at a temperature of 300 degrees Cent. Most of its surface is given over to the troostitic formation, but some martensite still remains. With a little experience one can closely judge the temperature at which any steel has been drawn by the amount of surface which is covered by any of the constituents that replace the martensite.

Fatigue tests, to which these specimens were submitted, showed that the steel in Fig. 6 would withstand many times the number of alternating vibrations of that shown by Fig. 5. Still this specimen did not show as great a longevity as did specimens that were drawn at still higher temperatures. Hence the drawing temperature was increased to 600 degrees Cent. before the steel was given its greatest resistance to fatigue. Such a specimen is shown in Fig. 7 and only sorbite can be seen. The fatigue tests showed this to be the toughest condition into which this grade of steel could be placed. Consequently this was decided to be the correct drawing temperature and the furnaces were so regulated that they would vary but very little from that point. This accuracy in furnace temperatures has enabled the company to produce steering knuckles that outlive other parts of the automobile.

A booklet entitled "Safety First" has been issued by the safety and welfare department of the Youngstown Sheet & Tube Co., Youngstown, O. It was prepared under the supervision of James M. Woltz, safety director. A large number of illustrations and descriptions of safety appliances in the Youngstown mills are included in the booklet.

The Goheen Mfg. Co., paint engineer, Canton, O., has issued the first number of a booklet called "The Scientist." The purpose of this booklet is to publish results of experiments and tests on metal preservatives, weather-proofing paints and damp-proofing paints.

Specifications for Malleable Iron

A Discussion of the Faults in Present-Day Methods of Specifying Malleable Iron Castings—Physical Tests Urged

BY ENRIQUE TOUCEDA

NO ONE should attempt to draft a set of specifications for any material, unless by virtue of his familiarity with both its physical properties, and process of manufacture, he is in a position to avoid making meaningless provisions, ones that may prove incompatible with any of the others; or the introduction of restrictions that might operate to prevent the manufacturer who understands his business from reaping the full benefit of his skill.

In formulating specifications for malleable iron castings, the engineer unfortunately, has been handicapped to a great extent through a lack of opportunity to become well acquainted with the details of the process; first through the policy of secretiveness practiced by the manufacturer in the past, but which happily has now entirely disappeared; coupled with his inability to find on this subject a trustworthy literature for self instruction, so easily obtainable in the case of metallurgy of any of the other ferrous products.

Owing to this, most engineers in the preparation of specifications for malleable iron castings, have resorted to about the only thing left for them to do under the circumstances, that is, ascertain what others had done in this connection, and either copy bodily the specification that appeared best, or modify, or add to its provisions such matter as judgment indicated would better adapt it to their particular needs.

That this is true may be readily ascertained by anyone who will take the trouble to look over the numerous specifications that have issued during the past few years. It will be acknowledged readily that the majority of them have been practically derived from one model, that they are children of the same parent, whose chief defects they have very faithfully inherited.

As I view it, those who have attempted to draft a set of specifications covering this material, have at the very beginning of their work made one fatal mistake, in that they have thought it necessary to pattern after and ape the character of specification that has been made for steel, failing to realize the many reasons why such a course must lead to confusion, and to the introduction of matter that on its face stamps the maker as incompetent in this particular field.

In order to make clear what is meant by this statement, let us see what steps the engineer takes in the formulating of specifications for carbon steel.

He first protects himself as to *quality*, and with the knowledge that the quality of steel is measured by the lowness of the phosphorus and sulphur content, he places an upper limit on these two elements that must not be exceeded. Having safeguarded himself as to quality, he next makes provision to obtain a steel that will be suitable for the purpose for which the steel is to be used; stiff, if that is the property desired; ductile, if that be the physical characteristic sought. He is able to provide for either of these conditions, or intermediate ones, by setting a definite limit as to the carbon content on one hand, or the ultimate strength on the other, either provision attaining the same end, for it is well known that strength, hardness and stiffness increase as the carbon content is raised, within the limits at least of structural material. In short, the lowness of the phosphorus and sulphur is the measure of the quality only, while the appropriateness or suitability of the steel for any given purpose is determined by the carbon content.

As a further safeguard, and in order to protect himself against the acceptance of steel which while conforming to the chemical requirements, may have been injured at some step in the process of manufacture, and which consequently will be defective structurally, provision is made whereby the steel must stand the amount of elongation and reduction of area that should normally accompany some particular carbon percentage or some particular ultimate strength if that be substituted in its place.

Now, from the standpoint of composition, what is it that determines *quality*, in the case of malleable iron? Is it established by the lowness of the phosphorus and sulphur content? Does the carbon content establish the suitability of the casting for any particular purpose? Should limits be placed on the silicon and manganese content as frequently is done in the case of steel? Let us discuss these things and see if we can arrive at any definite conclusions.

In the case of phosphorus, we know that combined carbon exaggerates its evil effects, which is therefore least felt in those products that are very low in combined carbon, such as wrought iron, or malleable iron, where in most cases it is entirely absent.

If the reader will refer to the specifications adopted by the American Society for Testing Materials, covering lap welded iron boiler tubes, staybolt iron and refined wrought iron, he will find no mention made of the permissible amount of phosphorus and sulphur content allowable in any of these products. As a matter of fact, composition is not considered at all, and nothing is specified but the physical requirements.

If a malleable casting contains less combined carbon than does wrought iron, why should restrictions be placed on the phosphorus content in the former case, and not in the latter, especially, in view of the fact that there is no product concerning which the engineer desires a stronger guarantee as to quality than staybolt iron? He surely must have good and sufficient reasons for permitting its quality to be measured solely by provisions governing its physical properties.

In connection with the manufacture of malleable iron, there is absolutely no temptation on the part of the maker to purchase pig iron higher in phosphorus than is perfectly safe, for he can obtain at no extra cost whatever, an unlimited supply in which the phosphorus will not exceed 0.16 per cent.

Actually, while the specifications of the American Society for Testing Materials permit an amount as high as 0.200 per cent, and the Society of Automobile Engineers 0.225 per cent, I can vouch that in the case of more than 30 of the manufacturers, the phosphorus content of their product is within 0.18 per cent.

Cases exist where a manufacturer is so located, that due to freight rates, he is able to purchase charcoal iron at a less cost than coke iron, and while the former has a phosphorus content considerably higher than the majority of malleable coke irons on

the market today, it must not be forgotten that it is only a comparatively short time since no coke iron was used in a malleable mixture, and that the best castings made in those days were as good as the best today.

As to the effect on quality of sulphur and manganese, which it is convenient to consider together, experience has shown that in order to obtain tough and ductile castings, it is necessary to maintain a certain ratio between these two elements. For instance, malleable iron castings with a manganese content of 0.36 per cent, and a sulphur of 0.03 per cent, all other elements being present in correct proportion, would result in an inferior product, though both of these elements are present in an amount that is not prohibited by any specification that I have ever seen. As a matter of fact, the low sulphur would be taken as an indication that the product was superior. The amount of sulphur that should accompany this manganese content, is 0.12 per cent, an amount that would condemn the castings in the eyes of many, and cause them to be rejected irrespective of what the physical tests might show.

The manufacturer should be permitted to adjust these elements to accommodate the composition of the pig iron he has in stock. There is no temptation for the manufacturer to purchase high sulphur iron. Such iron is made in the blast furnace through accident, not by design, and the amount made is very scarce comparatively. The difference in price between the high and low sulphur iron is about $0.75 per ton, and I will leave it to the reader to figure out how long it would be before the price would be raised for this grade of iron if the demand for it was great. When such iron is purchased, it is for one of two reasons: to use some on the annealing pot mixture, or to adjust the sulphur content so as to obtain the proper ratio of manganese and sulphur. It is much easier to obtain low sulphur iron than it is low manganese iron.

It now remains to be seen if it is wise to specify the permissible amount of silicon and carbon in the castings, which as in the case of manganese and sulphur are interdependent, and should be considered together. In order to make this clear to the engineer, a few words in connection with the process of manufacture are necessary.

Ordinary gray iron, iron in which most of the carbon is in the graphitic state, cannot be made stronger and tougher by thermal treatment, because the graphite that is present will remain after the treatment, as it originally existed in the iron, and any change effected in the combined carbon will simply make the iron softer and weaker.

It was discovered many years ago, however, that if no graphite is present in the cast iron, so that the entire amount of the carbon content is chemically combined with the iron to form the very hardest constituent that can occur in any ferrous product, such iron through proper heat treatment could be made very strong and tough. The malleable iron process is founded upon this discovery, and consists in first making white iron castings, free from graphite, from gray pig iron in which most of the carbon is graphitic, and then heat-treating the former so as to break up the hard carbide of iron into soft iron and free carbon.

In order to obtain white iron castings from gray iron pig, all that is necessary is to melt the pig iron in the presence of an oxidizing atmosphere, which serves to remove enough silicon to enable the remaining carbon to chemically unite wth the iron which it does in certain definite proportions. Having obtained the white iron castings, the next step is to heat-treat them, in order to break up the hard carbide of the white iron, into soft iron and free carbon, when the castings will be very tough and ductile, provided the sulphur-manganese and silicon-carbon ratios in the white iron were so adjusted that they offered no obstructions to reactions that take place during the heat treating.

Very superior results can be obtained when the silicon-carbon ratio is 1.25-2.30 per cent, and also when this ratio is 0.50-2.80 per cent, and there are intermediate ratios that yield good results.

From this it can be seen that if the engineer is going to specify anything as to silicon, he should at the same time consider the carbon content, and vice versa. When, however, he comes to consider the proper carbon for a specified silicon, it must be further stated that the ratios I have quoted above refer to the silicon-carbon in the white iron, specifications for which are not made. During the heat-treatment, some carbon is removed from the white iron, and the amount removed depends upon the thickness of the section, so that the matter is complicated by having to take this fact into consideration.

The above facts are briefly presented for the purpose of demonstrating how meaningless it is to make specifications similar to most of those that have been made in the past.

It is known to all who have studied this matter, that the structure of malleable iron conforms more closely to that of wrought iron than to steel, and it is generally lower in combined carbon than the former.

If engineers are willing to pass upon the quality of their wrought iron through physical requirements only, why should they object to doing the same in the case of the malleable iron castings?

If the engineer will make a specification for these castings, in which a limit is placed on the lowest strength and ductility that will be tolerated in tension; design a good test bar for such test; do the same for transverse test and center load; then make provisions to cover allowable variations in weight, dimensions, appearance of surface, absence of cracks, etc., he will be able to protect himself through the medium of a simple, direct and sensible specification.

The introduction of meaningless or unnecessary provisions simply results in trouble all around, and in confusion on the part of the inspector and the management. As an example of meaningless provisions, let us quote one from perhaps the most popular specification now in use.

"Malleable castings shall neither be 'over' nor 'under' annealed. They must have received their full heat in the oven at least 60 hours after reaching that temperature." Now, not only is no information given as to what temperature corresponds to "full heat", but if 60 hours is specified as being allowable to hold the castings at that temperature, is it right to hold the manufacturer accountable if the castings are "under annealed" provided they have been held at "full heat" for that length of time? If they are under annealed, the physical tests will disclose that fact very quickly and it is unnecessary to dictate to the manufacturer how he shall conduct his anneal, but if this instruction is deemed essential, it should at least be imparted by one who understands the process. The proper temperature to use to anneal white iron castings is about 50 degrees Fahr. above the critical temperature, and the critical temperature varies somewhat with the composition of the white iron.

The metallurgy of malleable iron is very complex, and as the lowness of phosphorus and sulphur do not determine the quality of malleable iron, and as the percentage of carbon does not determine the particular use to which the casting should be put, it is well to follow what has been done in connection with specifications for wrought iron, rather than for steel.

If a hardened, but undrawn forming tool is laid in a draft after quenching the chances are that the tool maker will have to make another.

Exploring for Adirondack Ores

Description of Work Being Carried On to Test Up Bulwagga Mountain Deposits Near Port Henry for Future Development

BY C S CLARK

A PAMPHLET recently issued by the Merchants' Association of New York, accurately states that the Adirondack or Lake Champlain iron ore deposits constitute one of the largest ore reserves in the United States. It estimates the visible supply at 250,000,000 tons, and adds: "There are large additional deposits which have not been surveyed." The truth of the last clause may be questioned; for while there are additional deposits which the state or United States geologists have not examined, there are many deposits which have been examined by eminent engineers and geologists, at the instance of private investors. Among these are the magnetite deposits of the Bulwagga Mountain district, south of Port Henry and north of Crown Point in Essex county.

Some attempts were made by speculators and farmers to develop these deposits from 1845 up to 25 years ago, but their means were insufficient and their methods were crude. As a result, the lands were abandoned until a recent date. The properties containing ore were held by farmers of the "poor white" type, and were involved in almost inextricable legal tangles due to conflicting land-patents, reservations of mineral rights, sales for taxes and the rooted disinclination of the natives to record deeds or mortgages.

From time to time, perfunctory examinations were made by geologists and Merrill, Kemp, Newland and others made reports upon the geology of the region, which gave scant space to the section covered by Bulwagga mountain.

Some pits, however, were sunk on the Butler mine property, Barton property, Blye property, Allen property, and elsewhere; and James Montgomery of stock car fame, is said to have been induced by a speculator to purchase a tract on the east side of Bulwagga mountain, for a very large sum. He opened a pit, but became involved in litigation, and suspended operations.

Examinations Made

A few years ago the Butler mine lot came into possession of a legal firm in New York, which is experienced in mining operations. This firm conducted a thorough investigation of the property, with the result that the Essex & Clinton Ore Co., 100 Broadway, New York City, was formed, and the latter immediately began to lease or purchase tracts in the Coot hill and Bulwagga mountain district. Kirby Thomas, of New York made several examinations of the field and was followed by E. R. Eaton Jr. Magnetometric surveys were made by Hamilton & Hansell and by Mr. Eaton; the whole region was mapped on a large scale and titles were perfected.

The mountain known on the maps as "Bulwagga" and the region known locally as Coot hill or Stanton hill, lie upon the west shore of Lake Champlain, about equi-distant from the Port Henry and Crown Point stations on the Delaware & Hudson railroad. The railroad runs at the base of the mountain and Bulwagga bay, which can be navigated by light-draft barges and tugs, is, at one point, barely 500 feet from the principal bodies of ore. The mountain, and its foot hills, form a steep fault-block with an altitude of from 1,100 to 1,400 feet. It shuts in on the south the gravel covered valley of Moriah, at the north end of which are the extensive deposits worked by Witherbee, Sherman & Co. Upon Bulwagga, the outcrop of the ore is at the same elevation above the lake as at Mineville; and since the trend or strike of the ore bodies is directly toward Mineville, and the rock outcrop is the characteristic gneiss of Mineville, it may be assumed that the Mineville and Bulwagga deposits were at one time continuous and connected. This was before the era when the deep

FIG. 1—BULWAGGA MOUNTAIN LOOKING ACROSS BIG GORGE

FIG. 2—TYPICAL OUTCROP OF GNEISS AND ORE IN THE BULWAGGA MOUNTAIN DISTRICT

FIG. 3—ORE PILES FROM TEST PITS AT BUTLER MINE, BULWAGGA MOUNTAIN

FIG. 4—PART OF COOT HILL WEST OF BIG GORGE

Moriah valley was eroded, and filled with glacial gravel.

In the ages since the Adirondack uplift, the rocks of the district have been altered greatly by aerial decay and circulating waters; so that, today, the discovery of ore bodies by purely geologic investigations, would be exceedingly difficult, if not impossible. In fact, many eminent geologists appear to have been deceived by appearances. Boring is equally unsatisfactory, as the movements which created the Adirondacks caused great changes in the original rock constituents, and forced the ore into blebs, pockets, or lenticular bodies, which the drill does not find readily.

The ores, however, are strongly magnetic and exploration by means of the Tilas scouting binnacle compass and Thalen-Tiburg magnetometer, followed by sinking small pits, has produced very satisfactory results. The overburden of soil, gravel and vegetation, is not deep and the accuracy of magnetometric charts is readily provable. Mining in this region probably will be cheap and easy, as open pits will be the rule.

Principally Magnetite

Ores thus far located and analyzed, are all magnetites, although large blocks of hematite have been found. The ores are practically free from sulphur, phosphorus or titanium. Two distinct varieties of ore have been found, one the characteristic black magnetite of the region and of Mineville, the other a "black and white" ore which greatly resembles the Lake Sanford ore, recently smelted at Cedar Point, of which a description was given in THE IRON TRADE REVIEW, Oct. 15, 1914. Assays of the ores from the main lenses of the first-named variety, give 59 per cent iron, while assays of ores from the numerous sidebands, run from 44 per cent to 54 per cent iron. These are surface ores, considerably weather-worn and leached, picked up at the top of the mountain, but exploration at the foot of the mountain, 1,100 feet lower, indicates that considerably better ores may be found at the bottom of the line of lenses.

The main line of lenses or pockets connected by stringers, as traced by magnetometric survey, outcrops and shallow pits, commences near the north line of the Butler mine lot and runs nearly south about 1,425 feet, where it is cut off by a sharp rise of land, indicating a cross-fault. It reappears again in the summit of Bulwagga mountain—here a high plateau—running entirely across a 50-acre lot near an old observatory, the trend of ore and formation being north 37 degrees west.

At the observatory, a great landslide, causing a steep cliff, has carried the ore on downward some 500 to 600 feet, and has twisted the line of lenses in the shape of a great V, with the point downward and each arm of which represents a deep ravine. The southerly arm, if extended, would reach the Bly pit, which is far up on the mountain, on its southern slope.

Other Deposits

About 2,800 feet of ore have been traced on the Montgomery, or Orebed lot and staked out. This added to the ore on the Butler mine lot, makes an aggregate of about 4,200 running feet of ore, estimated to be from 6 to 20 feet in width. It is not a continuous vein or lode, but might be likened to a string of enormous beads, as it consists of great lenses, connected by stringers, and twisted at numerous points by fractures and faults.

About a mile west of Bulwagga mountain and near the old Crown Point road, several pits had been sunk in a narrow vein which was of little value. But parallel to this vein and unnoticed, was a vein of magnetic gabbro, in which was a deposit of considerable importance. Large and promising deposits are found on the Lewis farm and several pits have been sunk in gneiss and gabbro and show excellent ore. But the distance of these deposits from railroad and lake and the great cost of either a

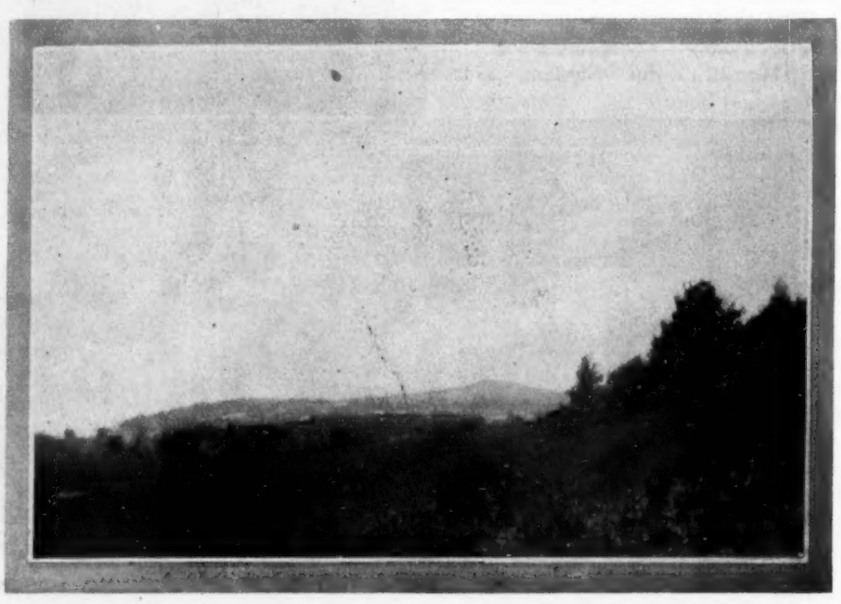


FIG. 5—ANOTHER VIEW OF THE BULWAGGA MOUNTAIN DISTRICT

railroad or aerial tramway over the mountain, is likely to deter operations for many years to come.

The Bulwagga mountain deposits are favorably located with respect to transportation facilities. It is believed ore could be carried direct from pit-mouth to mill and thence to cars or barges either by narrow gage road or aerial tramway, for approximately 5 cents per ton, and delivered at Albany or New York, by water when the new Champlain canal is completed for approximately 50 cents per ton. Cheap power possibilities are present. There are several large streams upon the properties, each with a fall of over 1,000 feet in a mile. It is probable that by impounding the water and bringing it to the foot of the mountain in a pen stock considerable hydro-electric power can be developed. The Essex & Clinton Ore Co. also has leased for long terms numerous tracts west of Bulwagga mountain, the Lee mine on the outskirts of Port Henry, and the Stevenson mine in the town of Westport. The Lee mine contains about 250,000 tons of concentrating ore, and the Stevenson mine at the northern end of the Cheever, Sullivan and Goffe properties, well known to miners, has a large deposit of excellent ore. The Lee and Stevenson mines are at some distance from the lake and railroad, but perhaps could be used to advantage in connection with Cheever mill and Cedar Point blast furnace at Port Henry. The properties in Crown Point, back of Bulwagga, are believed to contain not only iron ore in small quantities, but in some instances zircon and graphite. Zircon is being sought for in the region and a few rocks containing it, in small quantities, have been seen on Bulwagga mountain. Both Kemp and Bastin have reported crystals of zircon as abundant in granite pegmatites, near Port Henry and Crown Point. The financial stringency of the last few months and the state of the iron market, have postponed the execution of plans for extensive development work of the deposits in the Bulwagga district and the erection of a mill on the mountain. It may be expected, however, that with the opening of the enlarged barge canal to Lake Champlain, in the near future, and the advent of better business conditions, these extensive deposits will be put to commercial use. Included in the properties which have been secured is a part of one of the most imposing natural wonders of the Adirondacks, an immense gorge in the mountainside known by the natives as "The Big Hollow" but which deserves a more imposing name. It is 1,500 feet in depth and the sides are perpendicular, so that it forms a great amphitheatre to which access is had, only with great difficulty, from below. It is so well hidden, that many in Crown Point and Port Henry never have seen it, and it is said to have been the meeting place of the Mohawk nation in the days of its power. There are numerous large caves in the walls and Indian relics may be found in all parts of it. It is quite as beautiful and far more imposing than the Ausable Chasm, a little further north; and has the added attraction that from the summit of the precipices on the north and south sides, a view may be had for 100 miles up the lake, across the state of Vermont, to the Green mountains and to the White mountains beyond.

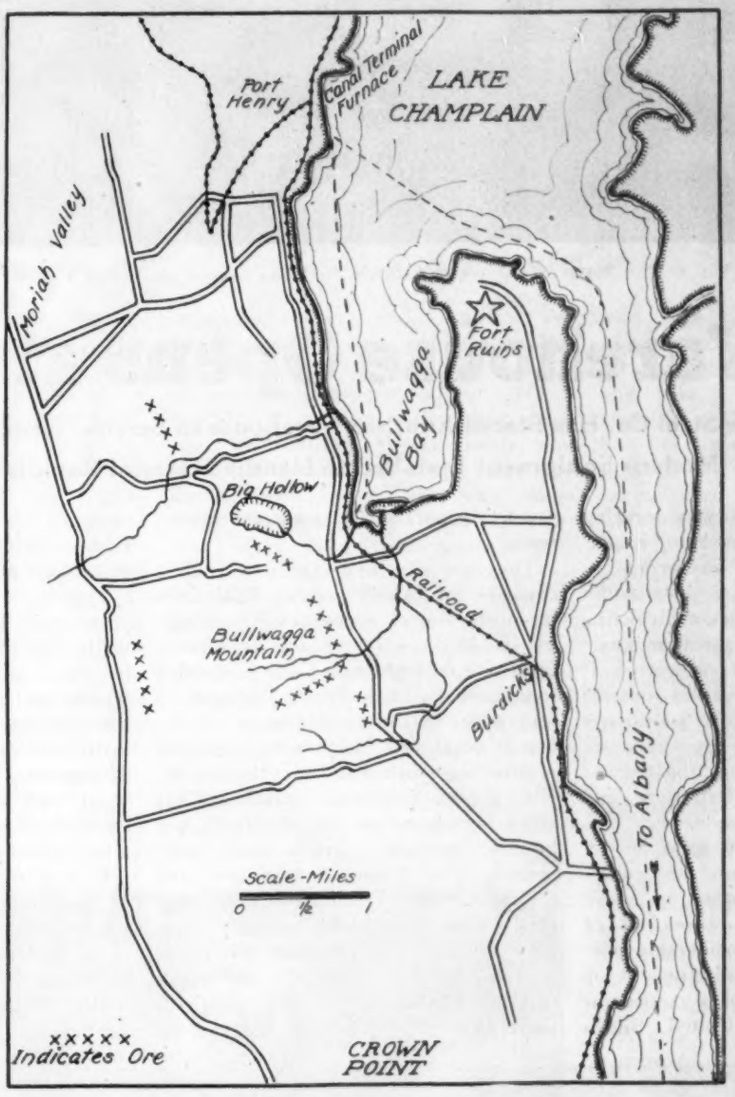


FIG. 6—SKETCH MAP SHOWING LOCATION OF MAGNETITE DEPOSITS AT BULWAGGA MOUNTAIN

New Alloy

Titanium aluminum bronze, a new alloy developed by the Titanium Alloy Mfg. Co., Niagara Falls, N. Y., is discussed in an eight-page booklet recently issued. The Titanium company after extensive research has developed special processes for the manufacture of this aluminum bronze, which include the use of titanium as a deoxidizer. The 10 per cent titanium aluminum bronze has an ultimate strength per square inch, using standard test bars, of 70,000 pounds; 20 per cent elongation in 2 inches; specific gravity of 7.5; co-efficient of friction, 0.0018; Brinell hardness number, from 90 to 100; linear contraction, 0.22 inch per foot, and a compression, 1,000 pounds load per square inch, of 12 per cent. It is well-known that aluminum bronze mixtures are not readily corrodible by sea water, hold a fine surface when exposed to the weather and work well generally. The Titanium Alloy Mfg. Co., in addition to specializing on aluminum bronzes, manufactures a general line of brass and bronze castings.

Crocker Bros., 30 East Forty-second street, New York City, have arranged with Woods, Huddart & Gunn, San Francisco, to handle exclusively and to distribute the pig iron, ferro-alloys and coke sold by Crocker Bros.

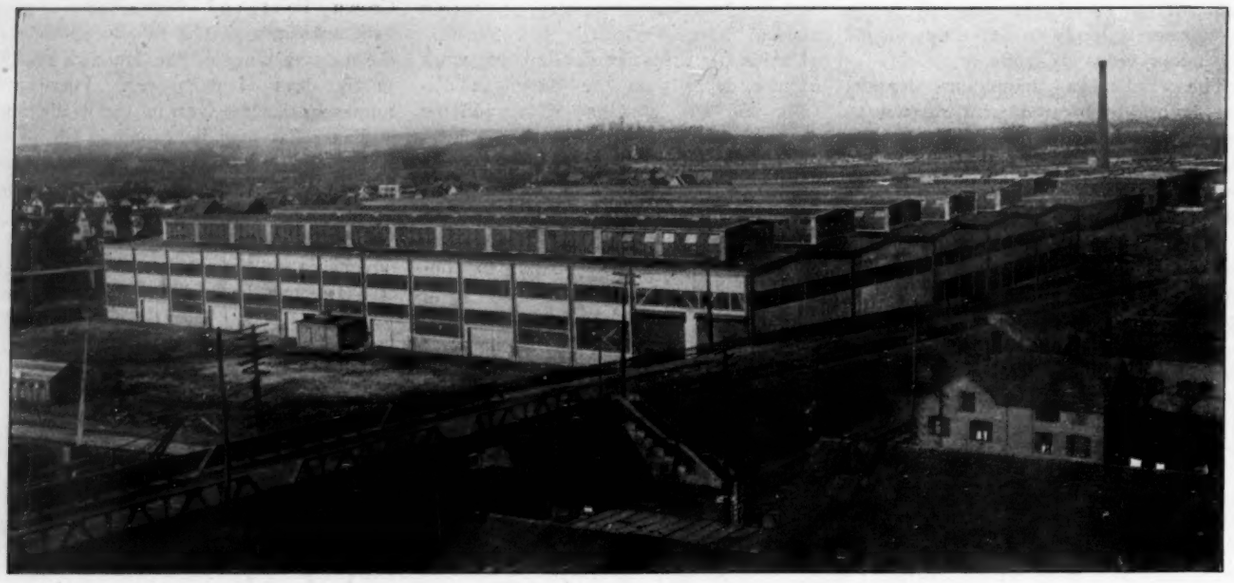


Fig. 1—New Boston Warehouse of Carnegie Steel Co., Located at Allston, a suburb

New Warehouse Opens at Boston

Carnegie Steel Co. Has Placed Another Warehouse in Service—Description of Modern Equipment Installed to Handle Material Rapidly

IN LINE with its policy of locating warehouses at important manufacturing centers, in order to facilitate the quick, local distribution of its products, the Carnegie Steel Co., Pittsburgh, has opened the new warehouse which it recently completed at Allston, Mass., a few miles outside of Boston. This is the fifth warehouse to be placed in service by the company, the others being located at Pittsburgh, Cleveland, Baltimore and Waverly, N. J. The new building embodies the most modern ideas in regard to construction, layout and equipment, and is well situated to serve its territory, which embraces all of New England and a considerable portion of Canada. In addition, it is intended to take care of a considerable portion of the United States Steel Corporation's overseas export trade.

The new Boston warehouse has a capacity for carrying about 30,000 tons of finished steel products. The building is 340 x 420 feet and is located on a site of eight acres. It is divided longitudinally into five bays, each 68 feet wide, as shown in Fig. 5. No. 1 bay is employed for carrying concrete reinforcing stock and heavy bar stock; No. 2 bay contains merchant bar stock, as shown in Fig. 3; No. 3 bay houses the plate stock and small shapes; Nos. 4 and 5 bays are used for the storage of beams, angles, channels, large rounds and squares. Railroad shipments are handled by means of two switches from the main line of the Boston & Albany railroad; these enter the building and serve the ends of the five bays. Wagon and motor truck shipments are made from bay No. 1.

The building is of brick and concrete and has a steel frame. The walls are of brick pilasters, spanned by expanded metal and plaster walls, which are hollow, in order to retard the entrance of moisture. The parapet walls and the roof of the building are of concrete, with wire mesh reinforcement, and are covered with asbestos roofing. Each bay is surmounted by a monitor, which extends nearly the full length of the building, the roofs of the monitors being of the same construction as the main roof. The sides and ends of the building, as well as the monitors, are provided liberally with steel sash, permitting adequate daylighting and excellent ventilation.

FIG. 2—FRONT VIEW OF CARNEGIE BOSTON WAREHOUSE

Perhaps the most interesting of the heavy duty machines at this plant is a high speed friction saw, shown in Fig. 4, and which is located between bays Nos. 3 and 4. This has a capacity for cutting shapes up to 24-inch, 115-pound, I-beams. This machine is operated from a centrally located pulpit. A feature of interest is that the arbor carrying the saw blade is supported on two sets of ball bearings, which are mounted in grease lubricated races. This type of construction succeeds the old ring oiling, water-cooled type of bearing. The saw is 42 inches in diameter and is mounted on a sliding frame, which has a 4-foot stroke. The sliding frame is actuated by a 10-horsepower motor, which is arranged to travel forward at a speed of 4 feet per minute and to return at a speed of 16 feet per minute. This motor is protected with limit switches, which regulate both the forward and return strokes. The saw is rotated by a 75-horsepower motor, belt-connected. The machine is provided with two live roll tables, one 50 feet long and the other 70 feet, each operated by a 20-horsepower reversing motor. The saw has a peripheral speed of 19,200 lineal feet per minute.

FIG. 4—VIEW OF HIGH SPEED FRICTION SAW

The plant is equipped with a plate shear located in No. 3 bay. This machine has a capacity for shearing 1-inch plates up to 71 inches wide, and the housings are so arranged as to admit of splitting a 60-inch plate. This shear is provided with a gag cylinder and with caster tables on each side, for advancing material through the shear. It is direct connected to a 30-horsepower motor, which is controlled by automatic push buttons located on the machine.

No. 4 bay is equipped with a gag press for straightening and bending structural shapes. It has capacity for handling shapes up to 24-inch, 115-pound, I-beams and is direct connected to a 15-horsepower motor. No. 4 bay also is equipped with a slow speed saw for cutting large rounds and squares. This machine is used for cutting to exact lengths; any shape can be handled on this saw. It is direct connected to a 15-horsepower motor. A machine which accompanies this saw is an automatic saw-tooth grinder, also located in this bay, which is driven by a ½-horsepower motor. Between Nos. 4 and 5 bays is located a double angle shear, driven by a 10-horsepower motor, and which has a capacity for shearing angles up to 6 x 6 x ¾ inches.

No. 1 bay is provided with a seven-spindle bar-twisting machine, which has a capacity for twisting seven ¾-inch bars simultaneously. This machine is direct connected to a 75-horsepower motor. Between bays Nos. 1 and 2 is a bar-shear of heavy construction. This is of the type which has been specially built by the Carnegie Steel Co. for several years for taking care of its heavy bar work. This machine is driven by a 10-horsepower belt-connected motor. It has capacity for shearing bars up to 9 inches square. It is used for shearing concrete and reinforcing bars, rounds, squares and flats, small angles and small shapes.

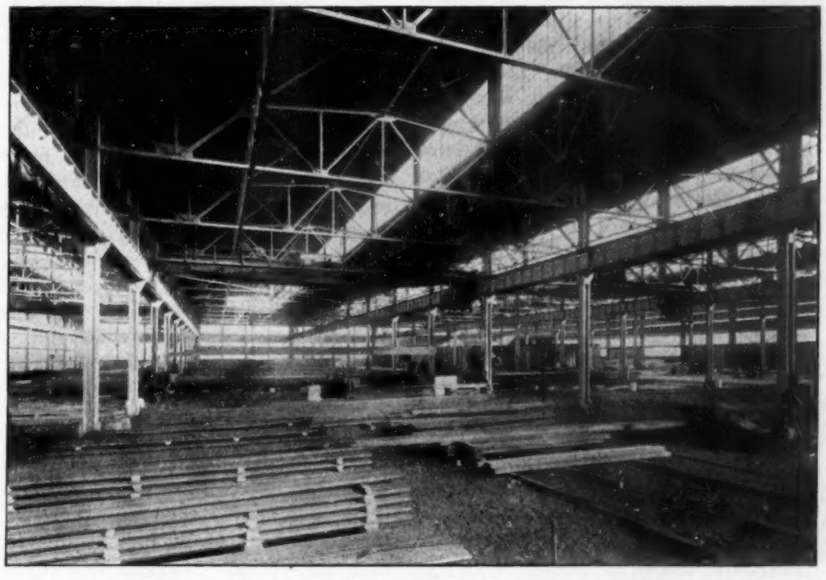


FIG. 3—VIEW OF MERCHANT BAR STOCK BAY, SHOWING METHOD OF HANDLING LONG PIECES BY MEANS OF TWO-TROLLEY CRANE

Each of the five bays, with one exception, is equipped with a 10-ton, two-trolley, electric traveling crane. The method of handling long shapes conveniently by means of two trolleys, instead of having to balance them in suspension from one trolley, is shown in Fig. 3. The bar storage bay, although equipped with a runway, has not yet been provided with a crane, since all of the material stored in this bay can be handled to advantage without the aid of such facilities.

Access is had to the cranes by means of a platform running across the ends of the five bays. Thus the crane operators are able to reach the operating cabs with convenience and safety. Safety features are employed wherever possible, throughout the building. All machines are provided with gear guards, belt guards, all set screws are flush with surfaces, and all platforms are provided with hand rails and toe rails, etc.

No. 2 bay, designed for the storage of the merchant bar stock, is provided with a series of bar racks. These are located in pits 4 feet deep and 12 x 50 feet long. The racks are of angles and channels and are 12 feet high. The pits are of concrete and the floor

surrounding them is of concrete, in order to insure durable construction, as well as to afford a good foothold to the workmen.

Two narrow-gage industrial railroad tracks run the entire length of the building, being provided with two 20-ton track scales, and with crossovers for transferring materials from one bay to another. On these tracks are mounted eight steel buggies, provided with rolled steel wheels, each of which has a capacity for carrying 30 tons. These buggies, when loaded with only 10 tons of material, can be transferred to any portion of the building by means of the cranes. The buggies are used for bringing materials which are to be shipped by truck or wagon from No. 1 bay and also are used in distributing incoming materials to different parts of the building.

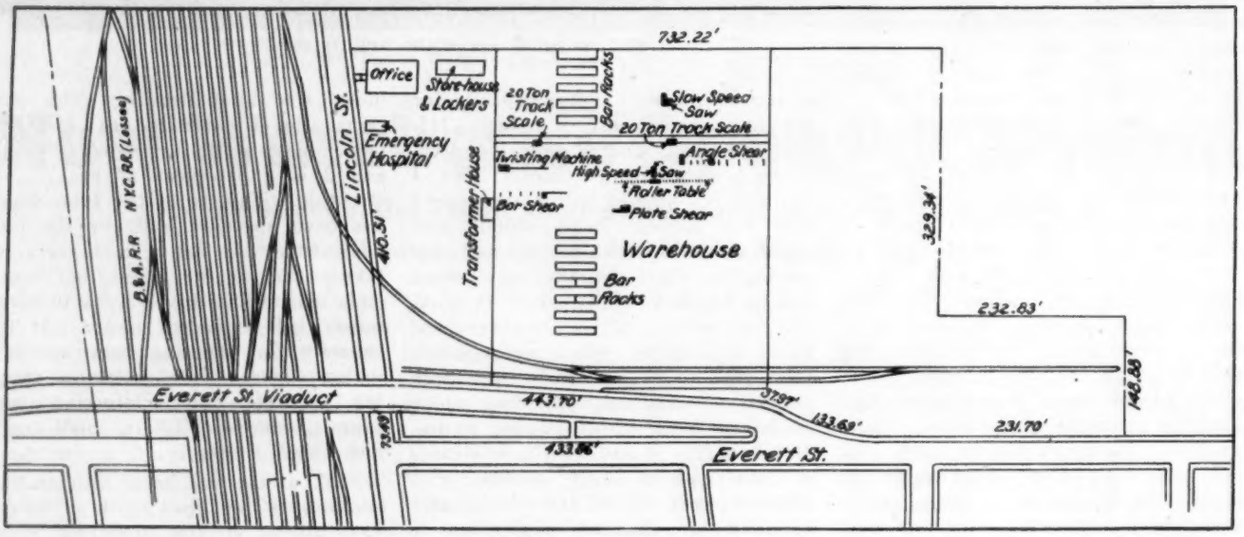


FIG. 5—LAY-OUT OF WAREHOUSE AND EQUIPMENT

The power requirements of the warehouse are supplied by a local electric power company. The current comes in at 2,200 volts, three-phase, 60-cycle, and, by means of transformers at the warehouse, is stepped down to 220 volts for the power circuit and to 110 volts for the lighting circuit. The transformer house is equipped with two 100-kilowatt, three-phase transformers for the power circuit and one 50-kilowatt single-phase transformer for the lighting circuit. The motors in this plant up to 15-horsepower capacity, are of the squirrel-cage type, while those of greater capacity are of the slip-ring type. All motors, as indicated above, operate on alternating current.

The company has completed plans for a two-story brick and concrete office building and a one-story lavatory and locker house, which will adjoin the warehouse; these will be erected shortly.

Book Reviews

The Art of Estimating the Cost of Work, by William R. Ferguson, naval constructor, U. S. N.; 5½ x 8 inches, 97 pages; published by the Engineering Magazine Co., and furnished by *The Iron Trade Review* for $1 net.

This book represents an attempt to point out methods of estimating the cost of work similar to that encountered in large jobbing shops and in ship yards. The method adopted by Constructor Ferguson is similar to the one that was employed by Frederic A. Parkhurst in working out the cost system of the Aluminum Castings Co.; this involves the standardization of numerous unit operations which can be given definite time and cost values. By summarizing the costs of unit operations, estimates on large projects, it is stated, may be made with an accuracy usually thought to be unattainable. The methods described have been used by the author for four years and the book was partly compiled from memoranda issued by him to the estimating and planning staffs at certain navy yards. The book contains interesting data, although its arrangement and mechanical features could easily be improved.

Hand Book of Machine Shop Management, by John H. Van Deventer; 4 x 7 inches, 374 pages, bound in leather; published by the McGraw-Hill Book Co., and furnished by *The Iron Trade Review* for $2.50 net.

Essentially a hand book, this volume contains a vast amount of information regarding the scientific management of machine shops condensed into limited space. The book, however, is excellently arranged and printed and the effect of over-crowding is avoided. The paragraphs are numbered, which facilitates indexing. The book is divided into seven general sections devoted respectively to general control, design control, equipment control, quantity and quality control, time and cost control, traffic and shipment control and shop hazard control. The book has been written with a definite purpose from a carefully selected viewpoint and an effort is made to give fundamental data on the elements and mechanism that enter into scientific management without outlining any particular method of management or shop system. One of the features of the book is its treatment of standardized equipment which, it is stated, is as important as a standardized product. It is believed that the book will form a useful text covering the needs of machine shop executives and men in training for machine shop executive positions.

All important bearings, even of the self-oiling type, should be examined at frequent intervals. In many shops, it is the practice to inspect all motor and generator bearings at least once each day, and to thoroughly overhaul all of the line shaft bearings either once every six months or once a year, depending upon the nature of the work. This means taking the bearings to pieces, thoroughly washing all parts, cleaning out the oil wells and refilling with fresh oil.

The Whiting Foundry Equipment Co. has issued a bulletin containing rules for safety in the operation of cranes. The rules were prepared by the National Founders' Association and the Whiting company will be pleased to forward a copy of the bulletin to any one upon request.

Welding With the Electric Arc

A Discussion of the Uses of Electric Arc Welding With Details of Its Cost and Adaptability

BY J F LINCOLN

FOR a process of such importance as arc welding, surprisingly little is known regarding it among many manufacturers who could apply it to advantage in their work. The available literature is incomplete. It is the object of this paper to consider the fundamental principles of arc welding of metals in relation to the following questions:

First—What metals can be melted by the electric arc?

Second—What difficulties are encountered in electric arc welding?

Third—What is the strength of the weld in comparison with the original piece?

Fourth—What is the cost of welding?

Fifth—What is the function of the arc welding machine?

There are many concerns that could use electric arc welding to advantage but which are overlooking its possibilities because of insufficient knowledge in regard to it.

All metals can be welded. Any two pieces of metal which are brought into contact at their melting temperature will adhere so that they are no more liable to break at the point of junction than at any other point. This is a well-known property of all metals and the welding process, therefore, is very frequently applied. The electric arc frequently is used in the welding process.

Difficulties in Welding

The difficulties which are encountered in welding are the following: Formation of oxide; expansion and contraction under heat; and burning through.

In the case of brass or zinc, the heated parts will be covered with a coat of oxide before they come to a welding temperature. This zinc oxide makes it impossible for two clean surfaces of the metal to come into intimate contact. It follows that some method must be adopted for disposing of this oxide at the weld and allowing the two surfaces to be welded, to come together without the possibility of oxide being included between them. This condition obtains in the welding of aluminum and of a great many alloys. In order to eliminate this coat of oxide it is usually necessary to puddle the weld, that is, to have enough of the metal melted at the weld so that the oxide is floated away from it. When this is done, the two surfaces which are to be welded are covered by a coat of melted metal on which the oxide floats, thus allowing two clean surfaces of metal to come together. This precaution, however, in case of steel, to which welding is applied to a greater extent than to any other metal, is not usually necessary.

Another difficulty which is encountered in the welding of a great many metals is their expansion under heat which results in a corresponding contraction when the weld cools, so that internal stresses are introduced which in extreme cases will result in cracking the metal at or near the weld. To eliminate this possibility, it is necessary, depending on the shape of the piece, to apply heat either all over the piece to be welded or at certain points, so that the uneven contraction giving rise to internal stresses will be avoided. In the case of cast iron, it is often necessary to anneal after welding, since otherwise the welded piece will be glass hard on account of chilling.

Another difficulty with arc welding is that very thin pieces of metal which are to be welded together and which are not backed up by something to carry away the heat, are very liable to burn through, leaving holes where the weld should be. This difficulty can be avoided by backing up the weld with a metal face, or by decreasing the intensity of the arc so that the melting through will not occur.

The practical limiting thinness of metal to which arc welding can be applied without metallic backing is approximately 22 gage, although thinner metals than this can be welded if the operator is very skillful.

The next difficulty with arc welding is the lack of skillful operators. Manufacturers in a great many cases look upon arc welding as being very complicated, and are very apt to become discouraged with the results of unskilled operators. They sometimes do not give the operators a chance to master the process before making up their minds that the method is not feasible. If the same point of view were held by manufacturers in regard to welding by means of the forge fire, blacksmithing would never have come to be practiced, and a broken piece of steel would always remain a piece of scrap. It does not require anything like as skillful handling to make a good arc weld as it does to make a weld on an anvil, and there are very few electric welds that cannot be handled successfully by an operator of average intelligence with one week's instruction, although his work will become better in quality and finish as he continues to gain experience.

Strength of Weld

Next comes the most important question of all; that is, what is the strength of the weld? The answer is that the strength of the weld is equal to that of the metal of which the weld is made. It should be remembered, however, that the metal which goes into the weld is really a casting, and has not been rolled. This means that the strength of the weld would be equal to that of the same metal that is used for filling, if used in the form of a casting. For example, two pieces of steel could be welded producing a tensile strength at the weld of at least 50,000 pounds per square inch. Higher tensile strength than this can be obtained by the use of special alloys for the filling material, or by rolling the weld. Tensile strength as great as mentioned will give a result which is perfectly satisfactory in almost all cases.

There are a great many welds where it is possible to build up, that is, to make the section at the weld a little larger than the section of the rest of the piece. By doing this, the disadvantage of the weld being in the form of a casting while the rest of the piece is in the form of rolled steel can be overcome, and the weld itself will be even stronger than the original piece.

Let us now consider some of the essential features of various types of arc welding machines which are in use. The three most important considerations in the design of the welding machine are: (1) the variation of the supply voltage as required

A paper presented at the meeting of the American Institute of Electrical Engineers, Cleveland, March 18-19. The author, J. F. Lincoln, is vice president of the Lincoln Electric Co., Cleveland.

by the arc; (2) power economy; and (3) conversion from alternating current to direct current energy. It is practically out of the question to apply the alternating current to arc welding since one electrode must always remain positive. In arc welding by means of the carbon arc, the piece to be welded is made the positive electrode, while in welding with a metallic arc either the piece to be welded or the piece used as a filler may be made the positive electrode.

The voltage across the arc is a variable quantity depending on the length and temperature of the arc and the gases in it. With a carbon electrode the voltage will vary from 0 to 45 volts. With the metallic electrode the voltage will vary from 0 to 30 volts. It is therefore, necessary for the welding machine to be able to furnish the arc with a current which can be varied as required both in quantity and voltage.

The simplest welding machine is an ohmic resistance in series with the arc. This is entirely satisfactory except, in regard to the cost of current.

By the use of resistance in series with the arc on a 220-volt supply circuit, from 80 to 90 per cent of the current is dissipated in heat in the resistance. Another disadvantage is the fact that most resistances will change with the temperature, thus making the amount of current delivered to the arc a variable quantity. There have been various methods devised for saving the power lost in the series resistance, and a good many machines designed for this purpose have been put on the market.

Practically all arc welding machines now in use consist of motor-generator sets, the motor of which is adapted to the existing supply circuit, and is direct connected to a compound-wound generator delivering current at approximately 75 volts. This current is applied to the arc in series with a resistance. It is evident that since the voltage across the arc will vary from 0 to 50 that from 75 to 25 volts must be dissipated in the resistance, although a considerable saving is effected over the use of a resistance in series with the full supply voltage. It is possible to construct a machine that will eliminate these losses by avoiding the use of a resistance in series with the arc. A machine of this kind will save its cost within a very short time, provided the welder is in steady use.

The following figures give the approximate cost of power for operating arc welding machines under average conditions, which are assumed as follows:

Cost of current, 2 cents per kilowatt-hour; metallic electrode arc of 150 amperes; carbon arc of 500 amperes; voltage across the metallic electrode arc 20; voltage across the carbon arc 35; supply circuit 220 volts direct current; a single resistance in series with the arc.

With the metallic electrode, the cost of energy will be 66 cents per hour. With the carbon electrode $2.20 per hour. If a motor-generator set with a 75-volt constant potential machine is used for a welder, the cost will be for the metallic electrode 25.2 cents per hour, and for the carbon electrode 84 cents per hour.

With a machine which will deliver the required voltage at the arc without the use of a series resistance the cost will be for the metallic electrode, 7.2 cents per hour, and for the carbon electrode 42 cents per hour. These figures assume that the arc is held continuously at its full value. This condition, however, is impossible in practice, and the actual load factor is approximately 50 per cent, which means that, as a welder is usually operated, the actual cost of operation will be about one-half of the amounts given above. It is evident, therefore, that it will not take very long to save the cost of a welding machine if all the power wasted in resistance could be saved.

LIVELY DAYS AT IRON RANGE TOWNS

First of a Series of Short Talks on Iron Mining

BY P B McDONALD

(In These Brief Articles, the Author Will Record Interesting Facts Concerning Mines and Miners

In 1906 "the Mesabi" was at the height of its "boom", and the range towns were lively places. Pits were being stripped and underground mines were hurrying development or production; wages were high and every one had money. For "eastern" mining camps, the Minnesota towns were "wide open". In Hibbing, the hotels ran roulette and crap tables in rooms just off the main entrances, and one evening I saw a lucky winner make thousand-dollar bets on the black for a dozen or so times; I think he was three or four thousand dollars ahead when he quit, which was high stakes for that "neck of the woods". Next spring came the Mesabi range strike, called by the Western Federation of Miners, and for several weeks we had steel plates from the blacksmith shop hung over doors and windows to stop bullets that occasionally flew when the strikers paraded to the mines and made demonstrations; our manager of mines (ordinarily a peaceful man) declared that no one should stop the mine pumps and the boilers, and he went to Duluth and brought back rifles, shot guns, Colt automatics (38-caliber steel cartridges), etc. We used to practice shooting at a mark on a rock pile with the automatics, and got fairly proficient. The strike fizzled out and the panic of 1907 made dull times for a while, but the range towns have had a vigorous, sound growth, and the Mesabi is one of the greatest, if not the greatest, of mining districts of the world, so far as magnitude of operations and tonnage are concerned. In its early days, not many years ago, experienced mining men of the old ranges in Michigan predicted that the Mesabi would be a fiasco, and that it was "only a blanket formation". Contrary to general opinion, a good percentage of the Mesabi iron mines is underground, although, of course, most of the largest mines are "open pit" properties.

Large Export Order.—Joseph T. Ryerson & Sons, Chicago, recently received a contract for several hundred machine tools for shipment to France and Russia. The order consists principally of lathes, 230 for turning projectiles and 91 of the turret variety. Eighteen Ryerson friction saws are also included. A large part of this order has been placed with other manufacturers and the remainder is being made in shops affiliated with the Ryerson company.

What It Costs

To Operate American Ships as Compared With British

How the United States Steel Corporation is paying a much heavier bill for salaries and wages to the crews of the foreign-built steamships for its ocean fleet recently transferred to American register is set forth exactly in a letter sent by John Hughes, of New York City, general agent of the United States Steel Products Co., to United States Senator J. H. Gallinger. Mr. Hughes' letter is in reply to a communication addressed to the Steel Corporation by Senator Gallinger asking how its operating costs have been affected by the transfer. Mr. Hughes says:

"The present and former scale of wages on our steamers and the percentage of increase is shown in the following statement:

	British. Average.		American.	Avg.	Increase. Per cent.
Captain	£25	($121.66)	$150-$180	$165	35.6
Chief officer	£15	(73.00)	$90		23.3
Second officer	£11.3.4	(54.34)	70		28.8
Third officer	£ 9	(43.80)	60		37.0
Chief engineer	£21	(102.20)	150		46.8
First assistant engineer	£15	(73.00)	100		37.0
Second assistant engineer	£11.3.4	(54.34)	90		65.6
Third assistant engineer	£ 8.10.0	(41.36)	80		93.4

Wages of captains under American scale vary according to seniority.
Wages of other officers and the engineers are fixed, being same on all steamers.
Safe navigation money to captain, $300 per year, payable annually Jan. 1, on showing a clean record for the previous twelve months.

"The wages of the following members of the crew vary on the different steamers depending upon the supply available and the port at which signed on. The steamship San Francisco is quoted as an example:

	British.		American.	Increase, per cent.
Chief steward	£8	($38.93)	$55	41.2
Second steward	4	(19.47)	25	28.4
Messroom steward	3	(14.60)	22	50.7
Chief cook	7	(34.07)	40	17.4
Second cook	5	(24.33)	25	2.8
Carpenter	7	(34.07)	40	17.4
Boatswain	6.10.0	(31.63)	35	10.7
Sailors	5.10.0	(36.76)	28	4.6
Firemen	5.10.0	(26.76)	32	19.6
Oilers	6	(29.20)	35	19.9
Donkeyman	6.10.0	(31.63)	35	10.7

"Owing to the unsettled conditions which have prevailed throughout the world since the outbreak of the present war in Europe, the increased cost of operation in the other departments cannot be fairly stated as we have no basis upon which to make a definite comparison."

Making a Range

Wm. H. Perkins, of the Walker-Pratt Mfg. Co., Watertown, Mass., delivered an illustrated lecture on "The Making of a Range", before the New England Foundrymen's Association, at its regular monthly meeting, at the Exchange club, Milk and Batterymarch streets, Boston, not so very long ago. Mr. Perkins' remarks covered the complete cycle of operations embraced in the manufacture of a range, extending from the mining of the iron ore, the making of the pig iron, the various stages of foundry operations and finally, the erection and storing of the finished product, ready for shipment.

Protest

Made by Belgian Manufacturers Against Seizure of Tools

Washington, March 23.—Seizure by the Germans of machinery and tools valued at $3,000,000 from plants in Belgium is made the subject of a protest which has been filed with the German governor general in Belgium by the Federation of Belgian Steel and Iron Manufacturers. The protest has been made public by the Belgian legation in this city.

It is claimed that the machinery and tools have been taken to pieces and sent to Germany and that in many cases no receipt was left in the hands of the legitimate owner to prove the nature, number and value of the seized property. The secretary of the legation said the steel industry in Belgium, along with other industrial activities there, has been completely paralyzed and said it would probably require many years after the war is ended before anything like normal conditions can be restored.

The protest says that an organization in Berlin has entered into a contract with the firm of Sonnenthal Jr., Cologne, to collect and deliver to German makers of war supplies all engines and tools seized in Belgium and France and to bring them back after the war is over. The statement asserts that the contract provides that the Sonnenthal company has the right and even is compelled, in co-operation with the gun foundry at Liege, to pick out in factories of the occupied territory those machines which seem most useful for the manufacture of German war supplies and to propose the seizure of the machinery.

It is also charged that raw materials, among them being copper and nickel, have been taken from private individuals and sent to Germany. The Belgian government says the alleged acts of Germany violate several articles of Hague conventions.

"By removal of these tools," says the statement, "the efforts made by the manufacturers to maintain a certain activity in the plants are nullified, and numerous workmen are obliged to remain idle and are facing starvation. These measures will also retard the restoration of industry after the war is ended."

Will Install Heroult Furnace

A license for the construction of a six-ton Heroult electric furnace for the manufacture of steel, has been issued to the American Steel Foundries by the United States Steel Corporation. This unit will be installed in the plant of the foundry company at Indiana Harbor, Ind. As previously reported, the Steel Corporation in recent months has licensed a one-ton Heroult steel furnace to the Lebanon Steel Foundry, Lebanon, Pa.; an additional three-ton to the Firth-Sterling Steel Co., Demmler, Pa., and a three-ton to the Electric Steel Co., Indianapolis, Ind., and others. This will make a total of 20 Heroult furnaces building or in operation in the United States.

Work on Hell Gate Bridge

Construction work on the Hell Gate bridge over the East and the Harlem rivers, New York City, which will have the largest single span of any structure in the world, is progressing steadily. The American Bridge Co., which is performing part of the work, has delivered and practically completed the erection of about 16,000 tons. One panel of the main arch on the Long Island side is under way. The main arch, according to present indications, will be completed this year, but that part of the viaducts contracted for by this company will extend into 1916. The McClintic-Marshall Co., which is constructing the viaducts on the Manhattan side, has finished perhaps 75 per cent of its work.

A large part of a $2,000,000 order for shells from the English government has been secured by the Dayton Mfg. Co., Dayton, O. The contract will be fulfilled at once.

Problems of Capital and Labor

Many Indictments Against Chicago Labor Leaders Will Be Returned, it is Reported—Exemptions of Clayton Law Will Be Tested

Chicago, March 23.—Unconfirmed reports are persistent that the federal grand jury, which has been investigating labor matters in Chicago since last July is about to return a large batch of indictments, possibly as many as 75, against labor leaders and members of a contractors' organization for having conspired to prevent outsiders from doing construction work in Chicago.

The grand jury adjourned March 19 until April 2, but it is said the indictments are drawn and waiting simply for some additional evidence, which is expected to be in hand when it assembles.

United States District Attorney Clyne refuses to dicuss the reports, but does not deny their truth.

The investigations began about the middle of 1914, when a contractor, goaded to desperation by demands of a labor union business agent, brought the matter before District Attorney Wilkerson and several indictments against business agents for conspiring to interfere with interstate commerce were returned after several weeks' investigation. Carrying the investigation deeper, it is asserted the discovery was made that not only were business agents "shaking down" contractors and machinery builders, but that a regular understanding existed between certain Chicago contractors and agents of labor unions to discourage and drive out all outside contractors who attempted to do business in competition with local concerns.

Briefly stated, the method employed in discouraging outsiders is as follows: First, a warning to abandon the contract or turn it over to a contractor who belonged to the local "ring". On refusal, troublesome demands were made by business as the price of being allowed to enter the Chicago field. If these demands were complied with, they were followed by others so progressively unreasonable that the victims finally were forced to refuse them. This refusal furnished an excuse for a strike and one would be called.

The combination of contractors and business agents is believed to have been so powerful that it forced local makers of building materials to refuse to furnish supplies to contractors who were under the ban. Usually this would drive the intruders out, but in some instances they sought to obtain materials from other cities. Shipment of these materials was interfered with, it is claimed, by business agents and thus involved the alleged violations of the Sherman act.

It is said that in one instance a business agent obtained several thousand dollars from an outside contractor for partial concessions and then told the victim that he could not let the matter go any further, as he had to protect the Chicago contractor who had stood by the organization for years. This contractor is said to have told his story to the grand jury.

Among the reports centering about this investigation is that a man who has looked after payments is a prominent capitalist who served in this capacity for 12 years and that the books he kept have been examined by government agents and some have been shown to the grand jury.

The conspiracy is so broad and involves so many angles and so many men prominent in business and financial life that the government is said to have paused before returning indictments to avoid making grave errors.

On resuming sessions April 2 the grand jury will decide finally what indictments should be returned, in view of whatever evidence is obtained in the meantime.

Would Like to Lend Millions

Washington, March 23.—Progress of the administration's work to aid the unemployed was described by Secretary of Labor Wilson in an address last week at the local Y. M. C. A. Secretary Wilson said federal aid to the unemployed was only in its infancy. Many problems, he asserted, are to be worked out. Sending of employes to places of labor was said to be one, and the danger of getting too many applicants for a limited number of jobs is another.

"We do not boast of having solved the unemployment question," said Secretary Wilson. "Our system by which we utilize the postal, agricultural and congressional branches of the government in seeking work for those who need it is in its infancy, and we are merely taking up practical questions as they arise."

Secretary Wilson said he would use $10,000,000 in receipts at immigration stations, collected from the head tax now placed upon immigrants, as a fund to lend money to community groups of immigrants coming into this country.

"A head tax of $4 is laid upon every immigrant," he said, "and it was never intended that this should form a source of revenue, yet it is $10,000,000 more than the cost of running the immigration system," he said. "If the government would allow the department of labor to have charge of this fund, it could lend it, not to single immigrants, but to community groups, to transport them to government lands and settle them thereon. The community would be security for the money loaned, which could be repaid when production and profits begin."

Labor Leaders Complain

Washington, March 23.—Complaints of employes against conditions in the canal zone have been filed in the form of a brief with Joseph P. Tumulty, secretary to the President. The brief was submitted through a committee of canal employes and, besides asking for the revocation of the executive order requiring payment of rent, light, etc., beginning March 1, representatives of the various organizations there strongly advocate an eight-hour law for the canal. It is charged that there has been no attempt to put into effect the eight-hour law applying to public works in this country. Hostlers work at least 12 hours, they say; engineers and conductors about 10 hours and other employes about the same.

The movement is being pushed by organized labor and has been under way for some time.

The committee also charges that alien labor has been and is now employed as artisans, despite the provision of the original canal act that American mechanics only should be employed. It is claimed that both white and black aliens are frequently given positions as skilled men that should go, under the law, to Americans. Objection is made to this and the President is asked to issue regulations that will forbid this in the future. Another complaint is that Americans are frequently sent for and given places on the canal which they do not hold long before a reduction of force leaves them without work. They think that at least six months' work should be promised any employe going to the canal from the states.

Money and Iron: Fact, Comment

Worst Year in History of the Steel Corporation

Annual Report, Like Those of Many Small Companies, Reflects the Extremely Unfavorable Conditions of the Past Year—Usual Stock Offer to Employes Not Made

THE thirteenth annual report of the United States Steel Corporation shows net earnings for 1914 were $71,663,615.17, the smallest in the history of the organization, and that there was a deficit for the year of $16,971,983.83 after making all deductions. The next poorest years in the history of the Steel Corporation were 1904, with net earnings of $73,176,522, and 1908, with net earnings of $91,847,710. The gross earnings were, however, smaller in both 1904 and 1908 than in 1914.

Maintenance and Renewals

The expenditures made by all companies for maintenance and renewals, including relining of blast furnaces, and for extraordinary replacements were $45,372,594.33 in 1914, compared with $59,942,970.38 in 1913, a decrease of 24.31 per cent. The principal expenditures in 1914 were: Manufacturing properties, $23,669,626.57; blast furnace relining and renewals, $2,055,165.10; coal and coke properties, $2,554,627.21; iron ore properties, $836,622.96; railroads, $10,175,302.13; steamships and docks, $671,514.78.

Capital Expenditures

The expenditures charged to the capital account for the acquisition of additional property and for additions and extensions to the plants and properties, less credits for properties sold, amounted to $22,746,031.06. In addition, there was expended $424,981.95 for stripping the overburden from ore, for development work at mines and for additional logging and structural erection equipment, making a total of $23,171,013.01. These expenditures include the following: Minnesota Steel plant, Duluth, $4,094,363, compared with $5,912,027 in 1913; other properties, exclusive of the Tennessee Coal, Iron & Railroad Co., $18,156,402, compared with $33,065,894 in 1913; Tennessee Coal, Iron & Railroad properties, $495,264, compared with $1,274,440 in 1913.

The total expended since April 1, 1901 for additional property and construction and net unabsorbed outlays for stripping and development work at mines amounted to $478,476,269.

Inventories.

Inventories show decreases for the year on all classes of materials, supplies and products on hand with the exception of iron ores, pig iron, scrap, ferro and spiegel, and rolls, molds, stools, etc. The following is a general classification of the inventory valuations Dec. 31, 1914, in comparison with the close of the preceding year:

	Dec. 31, 1914.	Dec. 31, 1913.
Iron ores	$57,874,986	$54,872,841
Pig iron, scrap, ferro and spiegel	9,344,968	8,755,139
Coal, coke and oth. fuel	3,460,218	4,630,597
Pig tin, spelter, copper, nickel, alum. and dross and skimmings	4,396,008	6,484,656
Limestone, fluxes and refractories	2,545,741	2,628,408
Rolls, molds, stools, annealing boxes, etc.	6,244,415	6,215,098
Mfg. supplies, stores and sundry items not otherwise classified	14,897,414	17,259,714
Ingots, steel	1,044,080	1,490,750
Blooms, billets, slabs, sheet and tin plate bars, etc.	8,426,734	9,246,963
Wire rods	589,587	728,916
Skelp	1,171,962	1,583,275
Finished products	31,660,054	34,315,536
Min'g sup. and stores (for ore and coal properties)	2,522,018	3,046,390
Railr'd sup. and stores	3,809,151	4,289,490
Merchandise of supply companies	675,159	894,003
Mat., labor and exp. locked up in bridge and struc. contracts $23,644,447		
Less, bills rend. on acct. 22,219,593	1,424,854	2,428,419
Stks. abroad and on consignment	7,380,012	7,845,017
Material in transit	623,675	919,579
Total	$158,091,036	$167,634,791

Volume of Business

The volume of business done by all companies as represented by combined gross sales and earnings amounted to $558,414,933, compared with $796,894,299 in the preceding year. The gross sales by manufacturing, iron ore and coal and coke companies to customers outside of the organization amounted to $380,228,143 in 1914, compared with $518,999,605 in 1913. The inter-company sales amounted to $129,565,720 in 1914, compared with $211,910,441 in 1913.

Improvement Only Temporary

The substantial lessening in the demand for products of the subsidiary companies which commenced in the midsummer of 1913 generally continued with some fluctuations throughout the year 1914. The improvement in demand at the opening of the year was not maintained in the succeeding months. In June and July some increase in demand was noticed, but with the outbreak of the European war the business offering decreased, so that in the closing quarter of the year operations reached the lowest average, as related to capacity, which has prevailed in any quarter since the organization of the Corporation. The decrease in export business was relatively greater than in the domestic trade, the decrease in the tonnage of rolled and finished products shipped for export having been 37.6 per cent, as compared with 23.3 per cent decrease in the domestic tonnage.

Contemporaneously with the decrease in demand for and output of commodities there was a decline in the prices obtained for nearly all classes of products. The decrease in prices received in 1914, as compared with 1913, averaged $2.54 per ton on the total tonnage of rolled and other finished products, and accounted in round figures for $23,000,000 of the total decrease of $65,420,098 in the earnings for 1914 as compared with the earnings of the previous year.

The unfilled orders of the subsidiary companies at Dec. 31, 1914, equaled 3,836,643 tons of rolled products; and on March 1, 1915, 4,345,371 tons. A considerable portion of this tonnage covers contract requirements extending through the first six months of 1915.

Since Jan. 1, 1915, there has been a material improvement in the bookings of export business and it is at present equal to the average of the last three years.

Taxes and Bonds

The aggregate sum of all charges to and allowances from gross earnings for the year to cover exhaustion of minerals and to cover deterioration arising from wear and tear of improvements and for obsolescence amounted to $64,847,641, in comparison with $84,237,608 in the preceding year.

The total charges for the year for taxes levied against the Corporation and its subsidiary companies, including the federal income tax for 1914, were $12,646,394, a decrease of $579,488 as compared with the amount for 1913. There was an increase during the year of $141,365 in the state and local taxes and a decrease of $720,853 in the federal income tax.

During the year a total of $10,009,397 of bonds, mortgages, purchase money obligations and mining royalty notes of the Corporation and the subsidiary companies was paid off. Of this total

$8,729,000 were redeemed through the sinking funds of the mortgages securing the bonds retired.

Bonds of subsidiary companies aggregating $9,347,000 were issued and sold during the year for account of outlays made for additions and construction and in refunding a part of the bonds matured and paid off in previous year. There was also assumed a real estate mortgage of $60,000 in connection with the acquirement of a small acreage of coal.

During the year, purchase money obligations of subsidiary companies were issued in the amount of $703,560 for part cost of five steamships purchased. The subsidiary companies also issued their notes (guaranteed by U. S. Steel Corporation) in the amount of $23,459,482.64 under a revision and adjustment effected of sundry iron ore mining contracts or leases. The notes so issued represented the balance of the determined and agreed amount of royalties which would become due and payable during the remainder of the terms of such contracts. Of the total amount issued $4,500,000 are interest bearing notes and $18,959,482.64 non-interest bearing obligations, and are payable in varying sums annually from 1915 to 1953. These notes take the place of previously existing mining royalty obligations.

	1914	1913	*Increase or Decrease*
EARNINGS—Exclusive of charges for interest on Bonds and Mortgages of Subsidiary Companies.	$81 746 317 89	$147 166 616 81	$65 420 098 95 Dec.
Less, Interest on outstanding Bonds and Mortgages of the Subsidiary Companies.....	10 082 902 69	9 985 271 98	97 630 71 Inc.
Balance of Earnings.....	$71 663 615 17	$137 181 344 83	$65 517 729 66 Dec.
Less, Charges and Allowances for Depreciation, applied as follows, viz.:			
To Depreciation and Extraordinary Replacement Funds	17 044 183 32	23 972 376 13	6 928 192 81 Dec.
To Sinking Funds on Bonds of Subsidiary Companies	1 903 041 68	1 850 477 80	52 563 88 Inc.
To Sinking Funds on U. S. Steel Corporation Bonds	6 195 982 41	6 037 798 99	158 183 42 Inc.
Net Income in the year.....	$46 520 407 76	$105 320 691 91	$58 800 284 15 Dec.
Deduct:			
Interest on U. S. Steel Corporation Bonds outstanding	22 239 086 53	22 532 690 98	293 604 45 Dec.
Premium paid on Bonds redeemed by Sinking Funds, viz.:			
On Subsidiary Companies' Bonds.....	87 331 46	99 720 26	12 388 80 Dec.
On U. S. Steel Corporation Bonds.....	822 200 00	683 597 50	138 602 50 Inc.
Balance	$23 371 789 77	$82 004 683 17	$58 632 893 40 Dec.
Add: Net Balance of sundry charges and credits, including adjustments of various accounts. .	124 978 40	Dr 787 697 55	912 675 95 Inc.
Balance	$23 496 768 17	$81 216 985 62	$57 720 217 45 Dec.
Dividends on U. S. Steel Corporation Stocks, viz.:			
Preferred, 7 per cent.....	25 219 677 00	25 219 677 00	.....
Common { 5 per cent. in 1913.....	.....	25 415 125 00	10 166 050 00 Dec.
Common { 3 per cent. in 1914.....	15 249 075 00	.....	
Surplus Net Income in the year.....	$16 971 983 83*	$30 582 183 62	47 554 167 45 Dec.
Appropriated from Surplus Net Income on account of expenditures made on authorized appropriations for additional property and construction and the discharge of capital obligations.....	.....	15 000 000 00	15 000 000 00 Dec.
Balance of Surplus for the year.....	$16 971 983 83*	$15 582 183 62	$32 554 167 45 Dec.

*Deficit

COMPARATIVE INCOME ACCOUNT UNITED STATES STEEL CORPORATION, FISCAL YEARS ENDED DEC. 31 IN 1913 AND 1914

tions were materially curtailed because of the severe depression in the iron and steel industry. By the expenditure of about $3,000,000 additional these plants will be ready for operation. It is hoped business conditions may warrant the completion of the work during the current year.

At the Edgar Thomson plant of Carnegie Steel Co. the installation of a new open hearth plant of 14 furnaces, together with gas producer plant and the enlargement and improvement of the blooming and No. 2 rail mills, was practically concluded, although there remained at the close of the year about $800,000 yet to be expended for installation of finishing equipment and facilities. The Carnegie Steel Co. completed the erection of a distributing warehouse for the New England trade on a site purchased for that purpose near Boston.

At the Gary plant of the Indiana Steel Co., there was practically finished during the year a flue dust sintering plant. At the South Works of Illinois Steel Co., the work of remodeling the rail mill was completed. At the Lorain plant of the National Tube Co., an additional hot blast stove and gas cleaning plants were installed at furnaces Nos. 2 and 5.

At Duluth, the Duluth, Missabe and Northern Railway Co. completed the construction of a new concrete and steel ore dock, 384 pockets, and track approaches, expending in 1914 $1,002,459. This company also expended $502,123 for remodeling its dock No. 1 to enable limestone to be handled over it, and for additional coal handling equipment on its coal dock.

During the year, the various subsidiary railway companies acquired by purchase or construction, as additions to their complement of equipment, four locomotives, 3,630 steel gondola and hopper cars, and 10 other cars, at a total cost of $3,990,939; and in the replacement of equipment, one locomotive, 205 steel gondola and hopper cars, and six other cars, at a cost of $242,618.

Work at Duluth and Other Places

Construction work on the new steel plant at Duluth, also on the new cement plant at same place, together with work on the adjoining town site of Morgan Park, progressed actively until the early fall of 1914, when construction operations were materially curtailed because of the severe depression in the iron and steel industry. By the expenditure of about $3,000,000 additional these plants will be ready for operation. It is hoped business conditions may warrant the completion of the work during the current year.

Vessel and Ore Properties

There were acquired during the year by the United States Steel Products Co., six additional steamships for service in the over-seas trade. One steamer was lost during the year, the full value of which was recovered from the underwriters. At the close of the year, the company owned nine steamers engaged in the over-seas trade, and operates under special charters additional vessels, varying in number from time to time as its business warrants.

At Jan. 1, 1915, the lease of the so-called Great Northern Railway ore properties by the Great Western Mining Co., a subsidiary of this Corporation, was cancelled in accordance with notice given in 1911 of the intention to exercise the option of cancellation on Jan. 1, 1915, and the properties not already surrendered were turned back to the lessors. During the period the properties were held by the Great Western Mining Co. (1907 to 1914, inclusive) that company mined and shipped from them 26,573,808 tons of ore, which tonnage fully covered the total minimums required to be paid for under the lease during the time it was held.

During the year, there was disbursed by the trustees of the United States Steel and Carnegie pension fund the

sum of $548,980.62. At the close of the year, there were 2,521 names on the pension rolls.

Employes and Wages

The average number of employes in the service of the Corporation and the subsidiary companies during the entire year 1914 was 179,353, compared with 228,906 in 1913, a decrease of 21.65 per cent. The total amount of the payrolls in 1914 was $162,379,907, in comparison with $207,206,176 in the preceding year, a decrease of 21.63 per cent. The average salary or wage per employe per day, exclusive of the administrative and selling forces, was $2.88, and including all employes, $2.97 per day. These average rates were slightly higher than the averages for 1913, owing to the fact that the general advance in wages made in 1913 did not take effect until Feb. 1 of that year.

On account of the disturbed and uncertain condition of the steel industry prevailing at the close of the year, the large number of employes who at that time were laid off because of mills being shut down or running only on part time, and also because of stock market conditions, it was decided not to offer employes the usual annual privilege of subscribing for stock under the plan which had been observed during each of the preceding twelve years. At the close of the year, there were 40,719 employes who had subscribed during the preceding five years and who then either held stock certificates in their own names or were paying for subscriptions in installments.

Bank of the Americas

The Bank of the Americas, with a capital of $5,000,000, is being formed in New York City to specialize in the financing of commercial operations between South and Central American countries and the United States. O. H. Fuerth, chairman of the Ethelburga Syndicate, Ltd., is the moving figure in the enterprise. Mr. Fuerth is a stockholder of the Commercial Bank of Spanish America, with headquarters in London and branches in various South American cities. One plan is to have the new bank take over the Commercial Bank and its branches.

First Boost

Washington, March 23.—Improved trade activity with the opening of spring is thought to be indicated by the action of the federal reserve board which has announced an increase of ½ per cent in the discount rates in the Atlanta, Ga., reserve district. The new rates, effective March 18, are 4½ per cent on 60-day paper and 5 per cent for longer maturities. This is the first time since the opening of the federal reserve system, Nov. 16, 1914, that an increase has been made in any of the discount rates. It has been indicated here that action taken with regard to the Atlanta reserve bank is a precursor of similar action in other reserve districts. Improved demand for money is held to promise the execution of such a general movement in this direction by other banks. Discounts at reserve banks for the past 10 days have greatly increased and have been taken as portending growing demands attendant upon industrial banking requirements for the spring.

The Yale & Towne Mfg. Co., Stamford, Conn., has declared the usual quarterly dividend of 1¾ per cent, payable April 1. Books close March 25 and reopen April 1.

Financial Notes

Directors of the Perfection Spring Co. have declared the regular quarterly dividend of 1¾ per cent on their preferred stock, payable to holders of record on April 1.

A temporary receiver has been asked for the Shimer Wire & Steel Co., Evansville, Ind., by M. G. O'Brien, vice president of the company, until business conditions can be adjusted. The company moved to Evansville about two years ago from Anderson, Ind., and is capitalized at $100,000.

The Otis Elevator Co. reports for the year ended Dec. 31, 1914, net earnings of $876,425, which compare with $1,157,396 in 1913. After deducting all charges for interest and patent expenses, and for renewals and repairs and maintenance of plant, the net was equal to 7.6 per cent on the $6,375,300 common

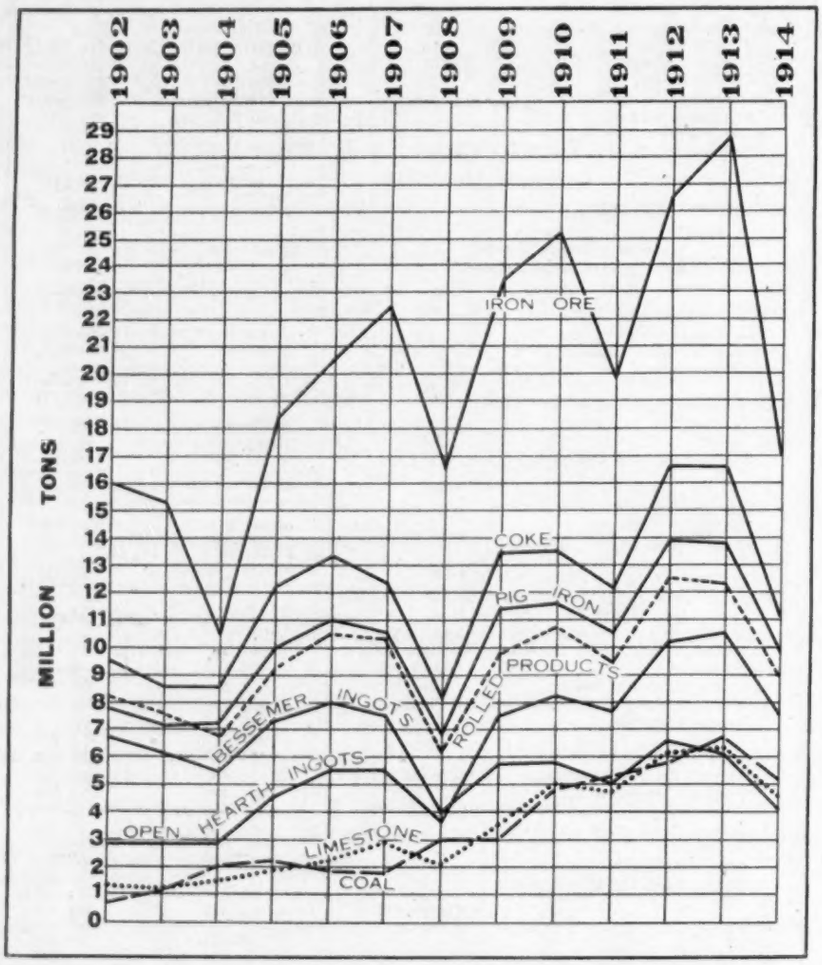
Products	1914	1913
IRON ORE MINED		
In the Lake Superior Ore Region	*Tons*	*Tons*
Missabe Range	10 894 463	21 634 206
Vermilion Range	1 112 854	1 301 163
Gogebic Range	1 469 601	1 871 700
Menominee Range	874 909	980 346
Marquette Range	496 896	583 266
In the Southern Ore Region		
Tennessee Coal, Iron & R. R. Co.'s Mines	2 186 258	2 367 770
Total	17 034 981	28 738 451
LIMESTONE QUARRIED	4 676 479	6 338 509
COAL MINED		
For use in the manufacture of coke	15 890 382	24 081 192
For steam, gas and all other purposes	5 271 911	6 705 381
Total	21 162 293	30 786 573
COKE MANUFACTURED		
In Bee-Hive Ovens	7 092 792	11 062 138
In By-Product Ovens	4 081 122	5 601 342
Total	11 173 914	16 663 480
BLAST FURNACE PRODUCTION		
Pig Iron	9 909 062	13 879 706
Spiegel	25 397	65 236
Ferro-Manganese and Silicon	117 998	135 788
Total	10 052 457	14 080 730
STEEL INGOT PRODUCTION		
Bessemer Ingots	4 151 510	6 131 809
Open Hearth Ingots	7 674 966	10 524 552
Total	11 826 476	16 656 361
ROLLED AND OTHER FINISHED STEEL PRODUCTS FOR SALE		
Steel Rails (Heavy and Light Tee and Girder)	978 907	1 927 745
Blooms, Billets, Slabs, Sheet and Tin Plate Bars	921 826	842 175
Plates	689 241	1 108 147
Heavy Structural Shapes	613 739	998 624
Merchant Steel, Bars, Hoops, Bands, Skelp, Etc.	1 423 740	2 024 192
Tubing and Pipe	818 435	1 186 740
Wire Rods	164 153	174 478
Wire and Products of Wire	1 380 376	1 432 182
Sheets (Black and Galvanized) and Tin Plate	1 075 419	1 280 537
Finished Structural Work	521 225	652 363
Angle Splice Bars and All Other Rail Joints	129 849	256 676
Spikes, Bolts, Nuts and Rivets	62 133	86 465
Axles	64 662	159 075
Steel Car Wheels	53 638	93 375
Sundry Steel and Iron Products	117 169	152 064
Total	9 014 512	12 374 838
Spelter	28 031	30 424
Sulphate of Iron	30 212	33 829
	Bbls.	*Bbls.*
Universal Portland Cement	9 116 000	11 197 000

PRODUCTION BY SUBSIDIARY COMPANIES OF THE UNITED STATES STEEL CORPORATION IN 1913 AND 1914

stock, compared with 12.03 per cent on the same stock the previous year.

The extent to which the iron and steel trade of Canada has suffered by reason of the general business depression is brought out clearly in the annual report of the Nova Scotia Steel & Coal Co., Ltd., for the fiscal year ended Dec. 31, 1914. The profits of the company for the year were $415,-164, as against $1,255,953 in 1913, a decrease of $840,789, a matter of 67 per cent.

B. O. Vollendorf, proprietor of the Uniontown, Pa., which closed its doors a short time ago, Senator W. E. Crow, of Fayette county, has introduced a bill in the Pennsylvania state legislature to confer new powers upon common pleas courts in that commonwealth. If the bill becomes a law, common pleas courts will be able to handle a situation similar to that confronting southwestern Pennsylvania. Briefly, the proposed law would give the common pleas court authority to conserve the assets of a debtor, upon application of a creditor, in



PRODUCTION BY SUBSIDIARY COMPANIES OF THE UNITED STATES STEEL CORPORATION, 1902-1914

Manitowoc Iron Works, Alpha, Iron county, Mich., has filed an involuntary petition in bankruptcy in United States district court, according to dispatches from Marquette. Liabilities are $7,038 and assets $4,617. Unsecured claims amount to $4,990 and accommodation paper to $2,000. Exemptions amounting to $680 are claimed. A hearing will be held shortly before Referee Looney, of Houghton, Mich.

To protect creditors of Josiah V. Thompson, coal land owner and president of the First National Bank of

times of unusual stringent or depressed financial conditions.

The report of the Calumet & Arizona Mining Co. for the year ended Dec. 31, 1914, shows net earnings of $3,085,535, or $5 a share, compared with $4,074,637, or $6.60 a share the previous year. Of the total net the Superior & Pittsburgh earned $2,895,-318, and the Calumet & Arizona $190,-216. The production amounted to 52,-667,929 pounds of copper, 922,143 ounces of silver, and 24,122 ounces of gold. The cost of the copper production was 8.19 cents a pound.

Industrial Stocks

At the close of last week, there was a spectacular advance in Willys-Overland and Bethlehem Steel stocks and some other industrial stocks made decided advances. The general list made moderate gains. On the whole, the week was one of strength, although some losses were recorded The money market at present is decidedly easier and banks at leading centers are piling up vast deposits. Gold imports from Canada, Saturday, brought the week's influx to $5,500,000. A feature of the bank statement was the gain of $11,069,000 in cash by the national banks. Twenty national banks in Chicago show an aggregate increase in deposits of $59,368,616 since the last previous reports of Dec. 31, 1914. Money rates show a tendency to sag at the interior cities. Estimates of the amount of new German war loans purchased by residents of the United States range from $15,000,000 to $20,000,000. This country is financing war and peace enterprises in large volume. The following changes were registered by stocks closely identified with the iron and steel business:

American Brake Shoe & Fdy. Co.	.....
Amer. Brake Shoe & Fdy. Co., prfd.	.....
American Can	+ 1⅛
American Can, prfd.	+ 1⅝
American Car & Foundry Co.	— ½
Amer. Car & Fdy. Co., prfd.	+ 2⅜
American Locomotive	0
American Steel Foundries	— ¾
Baldwin Locomotive	+ 3
Baldwin Locomotive, prfd.	.....
Bethlehem Steel	+11⅞
Bethlehem Steel, preferred	+ ¼
Colorado Fuel & Iron	— 1
Continental Can	+ 5¼
Continental Can, prfd.	+ 1½
General Electric	0
International Harv. of N. J.	0
Inter. Harv. Corp., prfd.	+ 2
Nat'l Enameling & Stamping Co.	+ 2½
Pressed Steel Car	+ 1
Pressed Steel Car, prfd.	0
Pullman Palace Car	— ½
Republic Iron & Steel Co.	+ ½
Republic Iron & Steel, prfd.	+ ⅞
U. S. Cast Iron Pipe & Fdy.	.....
U. S. Cast Iron Pipe & Fdy., prfd.	.....
United States Steel	+ ⅝
United States Steel, prfd.	+ ⅜
Westinghouse Mfg.	— ⅛

New Youngstown Stock

The directors of the Youngstown Sheet & Tube Co. decided to offer pro rata at par to the holders of both preferred and common stock, the entire $5,000,000 new preferred stock, for which authorization has been requested from stockholders at a meeting to be held April 6. This stock is to be offered for subscription to holders of record as of March 20. More than enough consents already have been received by the company to make the plan effective. The company now has outstanding $5,000,000 preferred and $18,500,000 common.

W. H. Donner, president of the Cambria Steel Co. and chairman of the Pennsylvania Steel Co., has returned from a several weeks' stay in Cuba.

Many Mills Are Busy

Contracts for Shells Awarded Canadian Companies Amount to $80,000,000—Dominion Material Used Almost Exclusively

Toronto, March 23.—Over 200 factories in Eastern Canada between Cape Breton and Winnipeg are now engaged in the manufacture of shells under the direction of a committee appointed by the Canadian government in September, consisting of Col. Bertram, as chairman; Thomas Cantley, of the Nova Scotia Steel & Coal Co.; Col. G. W. Watts, C. Carnegie, Lieut.-Col. Lafferty, of the Dominion Arsenal; Brig.-Gen. Benson, of the Ordnance Dept.; Col. C. Greville Harston, chief government inspector, and Col. David Carnegie, as ordnance adviser. The steel used in the manufacture of these shells is all Canadian and is being supplied by the Nova Scotia Steel & Coal Co., New Glasgow; Dominion Steel Corporation, Sydney; Steel Co. of Canada, Hamilton; Algoma Steel Co., Sault Ste. Marie; Electric Steel Co., Welland, and Canadian Foundries, Montreal. The copper driving band is the only component part of the shells not made in Canada. These shells are manufactured at one uniform price and undergo two inspections—first an inspection of component parts under the guidance of the shell committee, and secondly, inspection by the government officers including firing proof.

The contracts given out already amount to $80,000,000, and over 100,000 shells have so far been delivered in England. One Canadian firm is also handling a Russian contract for 5,000,000 shells.

The production of the Dominion Steel Corporation for February showed an encouraging increase over the January output in nearly every department. The following are the figures in tons: Pig iron, 20,621; steel ingots, 23,430; rails, 9,201; bars, 206; wire rods, 2,583; wire and wire products, 1,995; coal, 312,259. The only decrease was in the production of bars. The company is obtaining large war orders, but is chiefly handicapped by the difficulty of securing vessel accommodation. The company has closed a contract for the supply of toluol, a coke oven by-product, to the allies for use in the manufacture of high explosives. It has hitherto been largely manufactured in Germany and the price has increased greatly since the war started. President Plummer, of the Dominion Steel, and Senator N. Curry, of the Canadian Car & Foundry Co., are both in New York on war contracts.

A new building to be used for the manufacture of toluol, a liquid explosive, by the Dominion Steel Corporation at Sydney, N. S., is being rapidly rushed to completion, the company having received large contracts for this material for the use of the allies. The agreement calls for the delivery of a minimum of 600 gallons a day, which necessitates the installation of a plant of large capacity. The crude material will be shipped from Sydney to one of the armories in Quebec, where it will be refined.

Hon. Nathaniel Curry, of the Canadian Car & Foundry Co., has gone to New York to conclude negotiations in connection with some heavy orders for war material which are expected materially to increase the company's business.

At the Hamilton Smelting works of the Steel Co. of Canada great activity prevails, the plant running day and night and employing 1,500 men. The five open-hearth smelters were opened this week and the company is now turning out three heats of 500 tons each of steel. Two blast furnaces with the rod mill, blooming mill and bolt and nut department are also working double shift. The company has just completed a new department for the manufacture of shells at a cost of $100,000, and put 300 men to work.

In response to a cablegram from the general office of the Union in London, Eng., the Canadian executives of the Amalgamated Society of Engineers (machinists) are sending a number of their members to jobs in England. The first batch of 300 sail March 24. The executive intends to remove all members who are working in shops where low wages are being paid on shell work. Word has been received from British employers that good jobs are waiting those who want them.

Under the terms of the contract recently closed by the Algoma Steel Co. for supplying 35,000 tons of rails to the Illinois Central railway, the rails delivered are to be subject to what is known as the "nick and break test" regarded as the most severe form of testing rails. The contract price is $27 per ton, which is stated to be $5 per ton less than the lowest American tender.

George Hills has been placed in charge of the arc welding department of the Burke Electric Co., Erie, Pa. Complete welding systems are manufactured for use in steel foundries, rolling mills, railroad repair shops, boiler and tank works, etc.

Engineers Hold Meeting

The 306th meeting of the American Institute of Electrical Engineers was held at Cleveland, March 18 and 19, under the auspices of the Cleveland section. More than 300 members were in attendance. The arrangements for the meeting were in charge of Howard Dingle, Cleveland, while the industrial power committee headed by D. B. Rushmore, General Electric Co., chairman, had arranged an interesting series of papers covering topics of interest to the electrical engineers.

The papers presented were: "Application of Electricity to the Ore-Handling Industry", by C. P. Gilpin; "Line Disturbances Caused by Special Squirrel-Cage and Wound-Rotor Motors When Starting Elevators and Hoists", by J. C. Lincoln; "Answers to Some Questions on Electric Arc Welding", by J. F. Lincoln; "Troubles Encountered in the Operation of Carbon Brushes on Direct Current Generators and Motors", by E. H. Martindale; "Fractional Horsepower Motor Load", by Bernard Lester, and "Factors Involved in Motor Applications", by D. B. Rushmore. The paper on electric arc welding is reprinted in another part of this issue.

Bodies Not Burned

Last December, the *Daily Telegraph*, of London, Eng., published a statement that following the attacks on Ypres and Yser large numbers of bodies of dead soldiers were passing through the suburb of Lackan, by way of Louvain and Liege, to Germany, to be burned in furnaces. This story was included in a letter from the Birmingham, Eng., correspondent of *The Iron Trade Review*, published Dec. 31, 1914.

Dr. Schroedter, chairman of the board of directors of the Verein Deutscher Eisenhuttenlute (the German Syndicate), has written to an official of a steel company in Cleveland stating that the article published originally in London is absolutely without foundation. Dr. Schroedter says that the utmost care is taken in burying the dead and no such heartless method of disposing of the bodies as that described by the *Telegraph* has been even thought of.

Dr. Schroedter is a man of the highest character and *The Iron Trade Review* takes pleasure in publishing his statement, which undoubtedly is true. *The Iron Trade Review* also wishes to express regret that the statements published by the *Telegraph* were published in our columns.

Business News from the Capital

Federal Trade Commission Pleased by Attitude of Chamber of Commerce of the United States—Spirit of Co-operation Manifested

Washington, March 23.—Co-operation with rather than disturbance of the business of the country is the attitude the newly-created federal trade commission desires industry to know it has assumed. This feature stood out more prominently than any other during the week's events, encompassing the life of the new body. As pointed out by *The Iron Trade Review* last week, the preliminary work of the commission consists of a survey of its administrative powers, and plans to get itself established in its cramped quarters. Conferences at the White House and the department of justice have been held with the commission and out of each grew statements to the effect that the commission was to be a medium of "constructive helpfulness", and not a harassment to business. It almost seems that the organization had unduly strained itself to enunciate this policy, as though desiring to offset a contrary view.

Chairman Joseph E. Davies told *The Iron Trade Review* that the commission's "machinery is being oiled", and until it is started under way, which may be expected in the near future, it will not be possible to say just what program will be mapped out. It is apparent, however, that one of the first things to be taken up is the study regarding the right of domestic manufacturers to organize to build up their export trade through foreign selling agencies.

Mr. Davies was asked if it was the plant of the commission to give attention to the matter of contract cancellations, which are a source of injury to the iron and steel and other industries, but he replied it was too early to say what would be done in that direction. It is believed that the commission possesses jurisdiction to take up this matter.

Mr. Davies expressed himself as being pleased with the action of the board of directors of the Chamber of Commerce of the United States, who at their meeting in Washington last week, appointed a trade committee to promote co-operation between business and the commission. The personnel of the committee, said Mr. Davies, was a splendid one of big, broad-minded men. This committee consists of Henry A. Wheeler, Chicago, chairman, vice president of the Union Trust Co., Chicago, and formerly president of the Chamber of Commerce of the United States; Alfred B. Kock, Toledo, O., merchant and president of the National Retail Dry Goods Association; Rush C. Butter, Chicago, lawyer, of firm of Butter & Lynde; W. L. Saunders, New York, engineer and manufacturer, president Ingersoll-Rand Co.; Guy E. Tripp, New York, chairman of the board of the Westinghouse Electric & Mfg. Co.; Henry R. Seager, New York, professor of political economy at Columbia University; Alex. W. Smith, Atlanta, Ga., laywer; Joseph P. Cotton, New York, lawyer, of firm of Spooner & Cotton; Dr. W. C. White, Morgantown, W. Va., expert in mining conservation and a member of the faculty of the University of West Virginia.

Dissolution Suit Dismissed

Washington, March 23.—A case dealing with the Sherman law which created a great deal of attention last week was that relating to the United Shoe Machinery Co., the dissolution suit of the government against it having been dismissed by the United States district court at Boston. It is known that the decision is being reviewed by George C. Todd, assistant to the attorney general. Mr. Todd will make recommendations to Attorney General Thomas W. Gregory, as to whether an appeal should be taken and Mr. Gregory will pass finally upon this question.

The utmost that could be said to show that was there a purpose to acquire control of certain machinery related to machinery for bottoming shoes, or later of certain clicking or eyeletting machines, the court held. It had not been proved, the court said, that there was intent to acquire all concerns dealing in shoe machinery.

Occasion was taken by Mr. Davies to say that the Chamber of Commerce of the United States was largely responsible for the creation of the federal trade commission. The referendum taken among individual chambers belonging to the national body, he pointed out, had been overwhelmingly in favor of such a commission. He denoted that President J. H. Fahey and others of the national body are showing their good will toward the commission by the steps they have already taken and denoted his satisfaction at this attitude on the part of the members of the chamber.

"The idea of the chamber," said Mr. Fahey, "is to obtain the services on the committee of prominent, able men, who have the time and the disposition to work. We realize what a tremendous task there is before the federal trade commission, and the business men in the national chamber wish to do everything in their power to assist the commission. As soon as the commission is fully organized and in running order our committee will have a conference with it to see how the business men of the country can best serve."

The commission is making it plain that while it will be glad to confer with business men at all times, it cannot burden or bind itself to make rulings in advance on specific plans which have been and are being made by business men. The latter have submitted many inquiries to the department of justice as to what readjustments they will have to make to meet the requirements of the new commission. After a conference at the department, the commission announced that the department will turn these inquiries over to the commission. Formal regulations to be promulgated by the commission will answer many of these questions.

President Wilson held a conference with the commissioners and outlined fully his ideas regarding the purposes of the commission, describing the fundamental principles which caused the drafting of the law and the alleged evils which it is designed to correct. He sketched in general the policies which should be followed in the preliminary work of the organization, directing attention to the fact that big business is not bad necessarily because it is big. He emphasized the fact that it should be the duy of the commission to correct practices employed by certain large corporations to smother competition and restrict certain territory for operations.

No mention was made by the President of the commission's power as a tariff board, which in his Indianapolis speech he declared existed. It seems evident the commission will not start in with a policy of tariff investigation.

The effect of foreign combinations which come into competition with American industries served as the

Business News from the Capital

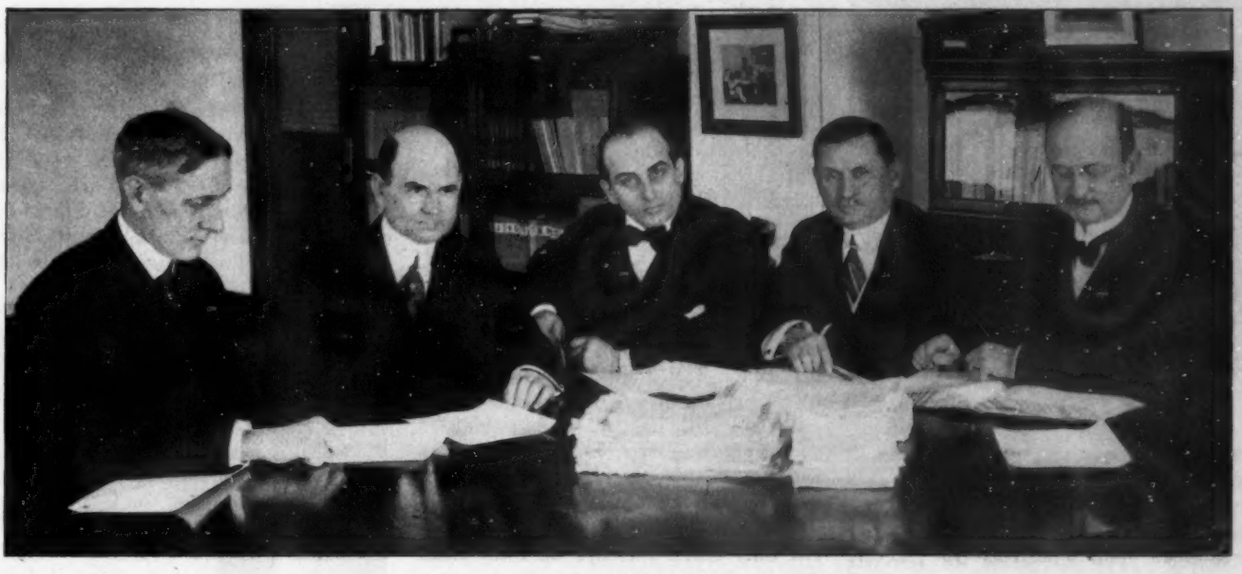
Relationship Between Trade Commission and Department of Justice—
Interest in Pan-American Conference

subject for a part of the conversation. Mr. Davies said after the conference that the agents of the bureau of corporations, of which he was head until it was consolidated with the trade commission, would be kept abroad for the commission to study these trade organizations and practices.

Upon the findings of the commission and the reports which come from these foreign agents, President Wilson probably will recommend legislation, if it is necessary, by congress which will permit combinations of American merchants and manufacturers to enter into active competition with these foreign combinations which now have a decided advantage even in American markets through their organizations.

Examination of the trade commission law by the department of justice has indicated that the department will continue its full responsibility for the enforcement of the provisions of the old Sherman law as to combinations and monopolies, while the commission will exercise jurisdiction over so-called illegal activities of less proportions and not involving a monopoly. The department studied the act to see if there would be any chance of conflict between it and the trade commission, and evidently has concluded there will not be, and that the department will not limit its authority in any substantial degree. Assurances have been given at the department of justice that it will co-operate fully with the trade commission.

The department will invite the view of the commission as to dissolution decrees against corporations held to be monopolies. Those cases held to be within the purview of restraint of trade, calling for dissolution and reorganization and involving business practices, will be taken up with the commission for an opinion as to the proposed decree. Cases involving "unfair practices" also will be referred to the commission by the department.



FEDERAL TRADE COMMISSION IN SESSION

Reading from left to right: George Rublee, Cornish, N. H.; Wm. J. Harris, Atlanta, Ga.; Joseph E. Davies, Madison, Wis., chairman; Edward N. Hurley, Chicago; Wm. H. Parry, Seattle, Wash.

Good Results Expected

Washington, March 23.—The Latin-American business conference, to be held in Washington on May 10, it is believed, will bring good results by assuring the countries of Central and South America that their interests and those of the United States are identical and that their welfare and not their territory is sought and that better business and social relations should be established. Particularly timely, it is pointed out, is the conference in view of the calamity created in Europe by the Great war. Channels of trade with belligerent nations and some neutrals in Europe have been either entirely cut off or almost hopelessly hampered in many instances and it has, therefore, been held as highly desirable, if not imperative, that the Latin-America countries and the United States take up these matters and discuss closer trade relations with each other.

Stories growing out of the forthcoming conference that it will deal with the matter of the countries represented getting together for "mutual defense" against the possibility, if not probability, of attack from the victorious nations now at war, are, of course, inspired tales, and entirely without foundation.

Secretary of State Bryan has outlined the purpose of the conference in his invitations to Latin-American countries. It is, he says, to establish closer and more satisfactory financial relations between the republics of America, and problems of transportation and commerce will also be discussed. Financial experts and diplomatic representatives will attend.

It has been pointed out that the immense natural resources of Central and South America offer a splendid field for American enterprise and capital. The north-and-south commerce of the Atlantic and Pacific coasts should equal, if not exceed, it is asserted, the east-and-west commerce of the Atlantic ocean. Those

Labor Shortage Serious

Labor Wage Concessions in Great Britain Do Not Satisfy Workers—Pig Iron Prices Advancing

Office of THE IRON TRADE REVIEW,
Prince's Chambers, Corporation St.,
Birmingham, Eng., March 15.

In all directions the tone is increasingly cheerful. The board of trade returns issued this morning are considered remarkably satisfactory,

CHARLES D. COBAU

showing an increase in imports during February upon those of a year ago. Although the exports are considerably less, they make a very good showing. The reduction in imports of iron ore, scrap iron and steel was £83,550 for February, and £43,200 for the two months. In iron and steel wholly or mainly manufactured, the reduction in value for February was £747,162, and for the two months £1,384,900. This will show Americans how large a gap there is to fill up in imported material. The exports of iron and steel are down by £1,609,005 for February and £3,801,761 for the two months. In quantities, the reduction is about one-half. The most serious difficulty we have to contend with is the labor problem, and unless a court of arbitration is set up with large powers, a very serious reduction of output is in sight. Large wage concessions have been made, but these reduce the willingness of the men to work overtime. In nearly every industry there are demands for higher wages, and a significant example was the hint given at the annual meeting of the Midland Iron and Steel Wages Board today that unskilled workers in the iron and steel trade will shortly ask for more wages because of the increased cost of living.

Pig Iron Prices Rising

Once more pig iron is showing a rising tendency and buyers are competing for supplies. The effect of this has been to raise Cleveland pig iron to 57s 2d ($13.72), and for forward delivery a premium of 1s (24c) and upwards on prompt rates is named. Makers generally prefer to do prompt business, thus keeping down stocks which have lately shown a tendency to increase, through the collapse of the export trade. The approach of the spring encourages the hope that shipments to Scandinavia may improve. But, in other directions, no great improvement is expected. There has been a further slight increase in warrant stock, the quantity now held being 124,000 tons.

Finished Iron and Steel

All branches of the iron and steel trade continue very strong. Yorkshire crown bars have been increased from £8 15s ($42) to £9 5s ($44.20) per ton. The reason given for this is the rising price of raw materials, especially of coal. The bar makers are benefiting from better orders for railway wagons.

In the semi-steel department there is still keen inquiry for foreign steel, but only small lots are on offer from America and Canada strictly for forward delivery, and the price quoted is £6 5s ($30) per ton for 2-inch billets, delivered equal to Warrington, on the Manchester canal.

Obituaries

Nathaniel L. Bradley, president of the Bradley & Hubbard Co., Meriden, Conn., manufacturers of gas and electrical fixtures, died at his home in that city recently, aged 85 years.

John M. Johnston, of Dallas, Texas, president of the Texas Harvester Co., a branch of the International Harvester Co., died March 16, at the Hotel Biltmore, New York City, of nephritis.

Henry H. Sessions, vice president of the Standard Coupler Co., of New York, and inventor of the vestibule anti-telescoping device, now used on most railroad passenger cars, the air brake for street cars and other railway devices, died recently at his home in Chicago. He was 68 years of age.

Charles D. Cobau, president of the Standard Engineering Co., Ellwood City, Pa., died in Phoenix, Ariz., recently. He was 43 years of age and had been a resident of Ellwood City 12 years. He went to Phoenix several weeks ago in the hope that the change would benefit his health which had not been good for some time.

James R. Darragh, whose sudden death was mentioned in last week's issue of *The Iron Trade Review,* was one of the pioneer blast furnace men and pig iron dealers in the Pittsburgh district. Although he had not yet reached his seventieth birth anniversary, he was one of the oldest members of the iron trade in western Pennsylvania. He had represented Rogers, Brown & Co., Cincinnati, in the Pittsburgh territory for a dozen years.

William Douglass Sloane, director of the firm of W. &. J. Sloane, New York City, and of the Eastern Steel Co., the Standard Roller Bearing Co. and other corporations, died at Aiken, S. C., March 19, aged 71 years. He was prominent in New York social and business circles, and had been a liberal benefactor of Yale university.

Jabez G. Twiton, secretary-treas-

JAMES R. DARRAGH

urer of the Australasian branch of the Massey-Harris Co., of Toronto, died March 18 at Melbourne, Australia, from injuries received in a motor accident. He was 62. He entered the service of the Massey-Harris Co. in 1884, and five years later was transferred to Melbourne to take charge of the company's Australian business.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

Henry R. Towne, president of the Yale & Towne Mfg. Co., New York City, and with works at Stamford, Conn., for 46 years, signified his desire to retire from the presidency, as briefly stated in *The Iron Trade Review* last week. Therefore, the office of chairman of the board of directors was created, to which Mr. Towne was elected. Walter C. Allen, vice president and general manager for a number of years, was elected president to succeed Mr. Towne. Mr. Allen entered the employ of the company 23 years ago. Schuyler Merritt, senior vice president of the company, will continue to hold that position and will devote special attention to the company's patent affairs and to the general direction of the bank lock department. He has been in the company's service for 37 years. J. H. Towne will continue as secretary. He entered the service of the company 24 years ago. John B. Milliken, treasurer, and Joseph A. Horne, general superintendent, will continue

WALTER C. ALLEN,
President, Yale & Towne Mfg. Co.

in those positions. It will be noted that the executive management, therefore, remains substantially as in the past and is in the hands of men long identified with the company.

At a meeting of the stockholders, held March 11, an increase in the capital stock of $500,000 was authorized. Substantially all of the present stockholders waived their rights of subscription to this additional stock in order, thereby to enable its acquisition by the officers and employes on whom will rest the chief responsibility for the further development and continued success of the business.

As a measure of growth of the Yale & Towne Mfg. Co., it is pointed out that at the beginning of Mr. Towne's presidency the number of employes was less than 100, but in recent years this has been increased to over 5,000. Also during the same period the capital employed in the business has increased from less than $100,000 to over $10,000,000. The executive and general offices of the company are located at No. 9 East Fortieth street, New York City, in a building erected and owned by the company. The Canadian business is conducted through a subsidiary corporation known as Canadian Yale & Towne, Ltd., located at St. Catherines, Ont.

J. S. Irwin, for several years identified with the American Sheet & Tin Plate Co., has accepted a position as superintendent of the plant of the McKeesport Tin Plate Co., McKeesport, Pa.

W. L. Wright, formerly vice president of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., has been elected a director and a vice president of the Keystone Watch Case Co., of Philadelphia.

Sir Arthur Trevor Dawson, managing director and vice chairman of the Vickers-Maxim Co., of England, has arrived in this country to give attention to matters connected with ordnance manufacture for the English government.

A. A. Cannon has been made secretary and treasurer of Milliken Bros., Inc., Staten Island, N. Y., succeeding George E. Barrett, who had represented the bankers in the reorganization of the company. The other directors were re-elected.

Orion J. Willis, for the last six years assistant manager of the St. Louis office of the American Sheet & Tin Plate Co., Pittsburgh, has been appointed manager of sales for the St. Louis district to succeed the late William J. Wetstein.

A. L. Noel, president of the Invincible Metal Furniture Co., which moved its plans and business from Monroe, Wis., to Manitowoc, Wis., last fall, has resigned the position and has retired from active connection with the concern.

R. Stanley Smith, chief engineer and designer for the A. O. Smith Co., motor trucks, pressed steel frames, etc., Milwaukee, has resigned

HENRY R. TOWNE,
Chairman of Board, Yale & Towne Mfg. Co.

to engage in the business of consulting engineer at Detroit, Mich., on April 1. He is the designer of the Smith-Milwaukee truck, the Smith motor-wheel and numerous other important products of the big Milwaukee plant.

Abbott A. Thayer left New York on the steamer Bergensfjord, March 20, for a business trip to Russia. Mr. Thayer is acting as a special representative for the Cincinnati Milling Machine Co. and other Cincinnati machine tool manufacturers.

Wm. Disston, active head of the Henry Disston & Sons Co., Philadelphia, manufacturers of saws, is seriously ill in the German hospital, Philadelphia. Mr. Disston went south about a month ago, after an operation, but failed to show the expected improvement.

Wm. H. Harman, who long has been prominently identified with the development of the hydraulic tool industry in the United States, has severed his connection with R. D. Wood & Co., Philadelphia, and has assumed charge of the hydraulic tool department of the Southwark Foundry & Machine Co., Philadelphia.

Orders for Export Hold Spotlight

Some Substantial Inquiries Pending for Tools Wanted by European Nations—
Purely Domestic Demand Increases at Some Centers

EXPORT demand for machine tools continues to hold the center of the stage in the east. Inquiries from abroad are numerous and almost the only factor which determines the placing of this business, particularly where lathes are involved, is the question of delivery. This foreign demand involves engine lathes and turret lathes, knee type milling machines, cutting-off machines, automatics and cylindrical grinders principally. One inquiry involves 70 lathes, another 50 lathes, and another 20. One of the surprising features, in view of the tremendous quantities of lathes which have been sold since the outbreak of the war, is that quotations continue to be made quite freely on this export business, and although a large number of manufacturers are sold up for a considerable period ahead, at least a few dealers have fairly good stocks of lathes on hand for immediate delivery. There is considerable activity, too, originating with manufacturers in this country who have booked or are figuring on contracts for the warring nations.

The Westinghouse Electric & Mfg. Co. just has booked another large shrapnel contract and is on the point of closing for a large additional amount of machine tool equipment. The Bethlehem Steel Co., in addition to inquiring for 300 lathes, as mentioned in last week's issue of *The Iron Trade Review*, is figuring on buying other machine tools, in batches of 20 to 50 of each kind. The A. P. Smith Mfg. Co., East Orange, N. J., is figuring on a war contract. The Snead & Co. Iron Works a few days ago was figuring on a war contract, but it is understood this company practically has given up negotiating. The war contract which was reported last week as being figured on by a large steel company has not been closed.

Domestic Business

Purely domestic requirements are somewhat larger, but the improvement is not of large proportions, most of such bookings involving only a few tools. An important buyer is L. F. Shoemaker & Co., Pottstown, Pa., which has closed for a multiple punch, several wall radial drills and other equipment for an extension to its plant; this company also is in the market for a few cranes. Another buyer is the Toledo Machine & Tool Co., Toledo, O., which bought two extremely large machines, a planer and a combination boring, milling and drilling machine. The Central Iron & Steel Co., Harrisburg, Pa., is in the market for a 150-ton ladle crane; the Pennsylvania railroad is in the market for a 7½-ton crane; the department of commerce, Washington, has put out an inquiry for seven 5-ton and one 10-ton dock cranes for Portugese, Africa; the New York Central railroad has an inquiry out for a pillar crane. The Delaware, Lackwanna & Western railroad is in the market for a 20-ton gantry crane and, in addition, is taking bids on a steam hammer, a lathe, a boring mill, a bolt cutter and a shear. The Ferracute Machine Co., Bridgeton, N. J., is expected to be in the market for machine tools shortly, as is also the city of Allentown, Pa., which is about to build two municipal machine shops. The Jersey City, N. J., board of education has closed for some 35 machine tools, for which it inquired last fall.

Tube Company Will Buy Tools

Machine tool dealers in the Pittsburgh district are enjoying an increase in the number of inquiries for all types of equipment, and sellers of machines for the manufacture of war material are obtaining a large number of attractive orders. The National Tube Co. has sent out a tentative inquiry for 30 automatic lathes, and the Schoen Steel Wheel Co. is understood to be quietly negotiating for several tools for the manufacture of war material. The Westinghouse Machine Co. is reported to have closed for a large number of automatic turret lathes, previously mentioned by *The Iron Trade Review*, and other Westinghouse interests are reported to be figuring on special equipment to fill orders for war material. As reported in last week's issue, the Carnegie Steel Co. plans the erection of a plant for the finishing of steel ties, manufactured at the Homestead Steel Works and additional equipment will be required if present plans are carried out. This plant will cost approximately $500,000.

Santa Fe Adds to Inquiry

Although fewer concrete instances are apparent at present than was the case a few days ago, a distinctly better sentiment seems to pervade the machine tool market in Chicago. Inquiry is somewhat increased and sales are being made with greater frequency than has been the case recently. Smaller shops seem to be buying here and there to add to their equipment, but larger concerns do not seem to be interested in a corresponding degree.

The Santa Fe, in addition to its inquiry mentioned last week, is asking for a 250-pound steam hammer and a sensitive drill. Builders of machine tools in the west are operating their plants almost at capacity, many working full time single turn and in some instances day and night work is found necessary to keep up with demand. So large a volume is for export that the prosperity of the builder is not an index to the activity of dealers, who do not find the domestic demand sufficient to keep them busy. Slowness of delivery on lathes and other sorts of tools is a deterrent to buying and throws some demand for new tools to second-hand or rebuilt machines. Inclination to save money wherever possible is evident in the demand for second-hand tools which are moving much more freely than new machinery. The Illinois Steel Co. plans to build a benzol plant at Gary, to be completed in November; it will cost approximately $800,000.

Cincinnati is Rushing

In Cincinnati, the rush to manufacture lathes continues. A well known local manufacturer of planers and another of shapers, have abandoned, temporarily at least, the manufacture of their products, and the former is busy in all departments making parts for lathes, while the latter is making milling machines exclusively. Demand is centered on 14, 16, 18 and 20-inch lathes, which are used by European countries

Permanently Level--

This **Ayer & Lord "Interior" Wood Block** installation in the plant of the Cleveland Foundry Company, Cleveland, is a good example of the permanent durability of Ayer & Lord Floorings.

The Cleveland Foundry Company is a large manufacturer of Blue Flame Oil Stoves, and its flooring is necessarily subjected to the heavy trucking of sheets and shaped steel, and the moving about of heavy machinery.

In spite of this rough treatment neither the blocks are injured nor the level of the floor disturbed.

Quality Forces Recognition

Another user writes us:—

"In reply to your inquiry of the 17th, be advised that the creosoted wood block flooring we have installed is giving excellent satisfaction. We have adopted it exclusively for our future construction. Some of our blocks have been down over three years, over which about 150 tons of material is trucked daily without any perceptible wear or unnecessary expense for replacement during this time."

Write at once for our little booklet "FLOORS"

Ayer & Lord Tie Company

General Office, Railway Exchange, Chicago

CLEVELAND, O.: 926 Illuminating Bldg. MEMPHIS, TENN.: 1402 Exchange Bldg.
KANSAS CITY, MO.: 1117 Rialto Bldg. PHILADELPHIA, PA.: 319 Perry Bldg.

to turn out shells and shrapnel as rapidly as possible. Heavier lathes are being used for the manufacture of guns, but the orders for the lighter tools are far in the majority. No new orders are being booked, as local shops are contracted up to full capacities for several months, and although numerous and attractive inquiries are before the market, they specify quick deliveries which cannot be met by the shops. The question as to whether or not these lathes will be thrown back upon the market as second-hand machines at the conclusion of the war and thereby cause a decided slump in the machine tool market, is receiving considerable attention, but the general opinion is that, as these machines are being used regardless of care or preservation in an effort to make shrapnel as rapidly as possible, they are being consigned to the scrap heap as fast as they are used up and it is believed they will never again appear upon the market

EASTERN STATES

BOSTON.—Fire damaged the iron working establishment of C. C. Parris, 7 Providence street.

BOSTON.—Keystone Farm Machinery Co. has been incorporated; $100,000 capital stock; by Alfred D. Abbenzeller, Albert M. Harding, Frank L. Taylor.

GREENDALE, MASS.—Fire on March 15, which originated from a case-hardening furnace, caused considerable damage at the plant of the Ramsdell Specialty Co.

PITTSFIELD, MASS.—New England Powder Co. has been incorporated; $100,000 capital stock; by Thomas F. Cassidy, Herman C. Palmer, Joseph A. Dennison, Patrick J. Ashe, et al.

BRIDGEPORT, CONN.—American Graphaphone Co., has begun work on two additions, one 60 x 100 and the other 50 x 145 feet.

BRIDGEPORT, CONN. — Bridgeport Arms Co. has let a contract for an additional building, and is understood to have the erection of five more buildings in prospect.

HARTFORD, CONN.—Cushman Chuck Co. has let contract for erection of a 2-story, 56 x 72-foot storage building.

NEW BRITAIN, CONN.—This city has let contract for erection of 48 x 165-foot vocational school and a 47 x 79-foot power house to Thos. W. Crowe, 65 Grovehill street.

STAMFORD, CONN. — Baer Bros. will erect a $13,000 factory on Fairfield avenue.

TORRINGTON, CONN. — Torrington Mfg. Co. is building a 1-story and basement brick addition, 90 x 120 feet.

WATERBURY, CONN.—Scoville Mfg. Co. is about to build a 4-story, brick addition, 80 x 100 feet.

PROVIDENCE, R. I.—Knight C. Richmond is the engineer for a 5-story, 100 x 120-foot storage building, which the Beacon Mfg. Co. will build at New Bedford, Mass.

BRONX, N. Y.—Sheet Lathing Corporation, machinery, building equipment, etc., has received its charter; $100,000 capital stock; Henry N. Morse, William Geraerdts, Frederick L. Kane, Huntington, L. I., incorporators.

BROOKLYN.—Fire did about $2,000 damage to Edward H. Zircardy's 1-story, sheet iron works, 87 Eighteenth street.

BUFFALO.—A. F. Oliver Gear Machine Co. has been incorporated; $20,000 capital stock; by M. S. Gibbs, C. L. Wiedrich and A. F. Oliver, Buffalo.

BUFFALO. — Bison City Engineering & Construction Co. has been incorporated; $10,000 capital stock; by G. T. Lee, W. H. Percy and A. Weaver, 996 Lafayette avenue, Buffalo.

HAMBURG, N. Y.—Wanakah Gas Corporation, transportation, heat, light and power, has received its charter; $10,000 capital stock; by W. W. Comstock, J. T. Roberts and F. E. Wattles, Buffalo.

HORNELL, N. Y.—Transcontinental Wheel Co., rotary appliances, wheels, means for lessening or changing friction, has been incorporated; $125.000 capital stock; by F. U. Ubezzi, E. J. and H. Orsenigo, 675 First avenue, Manhattan.

NEW YORK.—New York Central railroad is in the market for a pillar crane.

NEW YORK.—Phelps, Dodge & Co., 99 John street, are in the market for six machine tools at a machine shop at one of its mines in the southwest.

NEW YORK.—Boom Safety Device Co. has been incorporated; $50,000 capital stock; by K. E. W. Bichels, F. Bach and J. H. Boom, 57 Southern Boulevard.

NEW YORK. — Delaware, Lackawanna & Western railroad is taking bids on a steam hammer, 25-ton gantry crane, lathe, boring mill, a bolt cutter and a shear.

ROCHESTER, N. Y. — Buffalo, Rochester & Pittsburgh Railway Co. will erect six steel bridges in 1915; one in the Rochester division and five in the Buffalo division; the bridge in the Rochester division will be a viaduct over the Erie canal at Sugar Lake Junction 263 feet long.

SYRACUSE, N. Y.—Pierce, Butler & Pierce have awarded a contract to the Taylor, Hornby Construction Co., Syracuse, for erection of a 2-story, 40 x 65-foot pattern storage building.

ALLENTOWN, PA.—Allen Motor Co. contemplates the erection of a 1-story $10,000 factory at Bethlehem, Pa.

ALLENTOWN, PA.—Jos. A. Schmidt, city clerk, soon will take bids on a 2-story, 55 x 100-foot machine shop, to cost $20,000, to be erected for the city on Front street; in addition, the city will erect a 2-story, 20 x 100-foot, and a 1-story, 42 x 100-foot, machine shop and tool shed on Eighth street; Architect Chas. Blazer, Pilgrim street, has plans in progress for the latter building.

JOHNSTOWN, PA. — Cambria Steel Co. plans the erection of 42 additional by-product coke ovens, the contract for which has been awarded the H. Koppers Co., First-Second National Bank building, Pittsburgh.

JOHNSTOWN, PA.—Dale Light, Heat & Power Co. plans the erection of a power plant, and will buy necessary equipment, including steam turbines; Stine & Webster, engineers, New York City, have the plans.

NEW CASTLE, PA.—Grasselli Chemical Co., Cleveland, will double the capacity of its plant here, at a cost of about $200,000; one building will be 150 x 350 feet and another will be 85 x 180 feet; buildings will be of steel construction; Henry E. Rappold is manager of the local plant.

PENN STATION, PA.—Hockinsmith Wheel & Mine Car Co. will erect a new machine shop, 90 x 90 feet, the contract for the erection of which has been awarded the Riter-Conley Mfg. Co., Pittsburgh.

PHILADELPHIA.—Department of supplies, City Hall, room 312, will take bids until March 30 for an air compressor.

PHILADELPHIA—Doyle & Co. will rebuild their foundry at Meadow and McKean streets, which was damaged by fire, for E. E. Brown & Co.; cost of repairs will be $3,500.

PHILADELPHIA.—Barrett Mfg. Co. has let a contract to A. L. Carhart for a $10,000, 1-story, 62 x 134-foot brick plant to be erected on Tucker west of Bermuda street.

PHILADELPHIA.—John Maneely, 309 Arch street, valves, pipe and fittings, has let general contract for erection of 1-story, 116 x 195-foot plant, to M. Ward Easby, 1420 Chestnut street; the new building will be erected at Erie avenue and Algon street and will cost approximately $13,000.

PITTSBURGH.—Edward P. Block, architect, has completed plans for a warehouse for A. Caruso & Sons, commission merchants, 2021 Penn avenue.

PITTSBURGH.—Carnegie Steel Co. has completed plans for the erection of a plant for finishing, dipping and straightening steel ties at Munhall, Pa.; the plant will operate in connection with the steel tie mill at the Homestead Steel Works at Munhall.

PITTSBURGH.—Lacollin Grading Machine Co. has been incorporated at Dover, Del., to manufacture and sell wood and metal excavating and grading machinery; capital stock, $100,000; incorporators, T. A. Brady, Pittsburgh; A. E. Fichtues, Conemaugh, Pa.; J. R. Worley, McKeesport, Pa.; T. A. Nicodemus, H. L. Wagner and J. W. Wort, all of Johnstown, Pa.

ROYERSFORD, PA.—Buchwalter Stove Co. will build a 1-story blacksmith shop; J. V. Poley is the architect.

SOUTH BETHLEHEM, PA.—In addition to inquiring for 300 engine lathes, as reported in last week's issue of *The Iron Trade Review*, the Bethlehem Steel Co. is inquiring for a large number of other machines such as turret lathes, automatic screw machines, milling machines, grinders, etc; in addition, the company has plans in progress for putting up another addition, to cost about $15,000.

WILKINSBURG, PA.—Bids on superstructure of the proposed Pennsylvania railroad station here will be asked shortly by William H. Cookman, architect in charge; the erection of the station is included in an extensive program of improvements recently undertaken by the Pennsylvania railroad.

YORK, PA.—York Wagon Gear Co. suffered considerable damage by fire recently.

BRIDGETON, N. J.—Ferracute Machine Co. is figuring on the steel for a 100 x 100-foot addition to its machine shop.

EAST ORANGE, N. J.—A. P. Smith Mfg. Co. is figuring on a contract for making shrapnel.

EAST ORANGE, N. J.—International Steel & Ordnances Corporation has been incorporated to deal in steel; $100,000 capital stock; by H. H. Picking, C. O. Geyer and L. Mathews, Orange, N. J.

NEWARK, N. J.—Essex Press Co. is having plans prepared for a $150,000, 8-story concrete building at Halsey street and Maiden lane.

NEW BRUNSWICK, N. J.—Johnson & Johnson are about to erect a plant which will be leased by the Neverslip Co., manufacturers of horseshoes; it will be located at Nielson and Hamilton streets and will be 150 x 167 feet, 1-story, with provision for two additional stories later on.

PATERSON, N. J.—Acme Silk Mfg. Co. has been incorporated; $25,000 capital stock; by J. Kempner, H. Davidowitz, H. Cohen.

PERTH AMBOY, N. J.—This city will erect a new municipal lighting plant to cost $125,000; Runyon & Carey, 845 Broad street, Newark, N. J., have been appointed engineers.

PRINCETON, N. J.—A $220,000, 3-story dormitory, 220 feet long, will be erected at Princeton university.

TRENTON, N. J.—Plans have been prepared for a $250,000 theater on the site of the Elmore building, 141 East State street, by the Shuberts; Thomas Lamb, New York City, is the architect.

WASHINGTON, D. C.—Bureau of supplies

and accounts, navy department, will open bids till March 30, for eight simplex feed pumps for the Brooklyn navy yards; till April 6 for two 25-kilowatt turbo generators and one simplex vertical pump for the Mare Island navy yard.

WASHINGTON.—Proposals will be received until 10 o'clock, April 7, at the office of the general purchasing officer of the Panama canal for steel, iron, steel and iron pipe, pipe fittings, steel wire, cap screws, stove pipe, bronze bars, babbitt metal, white brass, sheet brass, sheet and bar copper, copper tubing, brass tubing, brass clean outs, lead pipe, sheet lead, sheet zinc solder, portable forgings and eyes and other materials.

CENTRAL STATES

ASHLAND.—Commissioners of Ashland and Wayne counties have recommended ditch improvements, which will call for the construction of bridges at a cost of about $35,000.

BARBERTON, O.—Pittsburgh Valve & Fitting Co. contemplates the erection of an addition to its plant here.

BOWLING GREEN, O.—Citizens of North Baltimore, O., have subscribed $25,000 toward a factory for making tires for Ford automobiles.

BRYAN, O.—C. R. Lowe, clerk of county commissioners, says bids will be advertised shortly for the 60-foot, steel Ager bridge and the 144-foot steel Schluker bridge; plans by W. H. Davis, engineer.

CAMBRIDGE, O.—County Engineer Weedon has prepared plans for a concrete, and a steel bridge over Wills creek; the type has not been definitely decided upon by the commissioners, but $27,000 bonds for its construction will be immediatedly sold and bids advertised for within 30 days.

CANTON, O.—Republic Stamping & Enameling Co. has increased its capital stock from $1,200,000 to $3,500,000.

CANTON, O.—Plans for the construction of a viaduct under the Pennsylvania railroad tracks at Dueber avenue now being prepared by the railroad engineers will not be submitted to the city until about April 1.

CHILLICOTHE, O.—County commissioners have ordered that either a wooden and steel bridge or an all steel bridge be constructed over Paint creek at Crooked bridge.

CINCINNATI.—Towle-Cadillac Co. will build a repair shop for automobiles 60 x 75 feet; light equipment will be needed.

CINCINNATI.—United States Can Co., Norwood, will build an office building 32 x 60 feet, of brick and concrete construction.

CINCINNATI.—Wm. Leimann, city auditor, will receive bids until noon, April 14 for $250,000 bonds for extending and improving the city waterworks.

CINCINNATI.—Big Four railroad will build a roundhouse on Liston avenue, Sedamsville, for which a limited amount of equipment will be required.

CINCINNATI.—A factory for the manufacture of lock nuts will be located in Cincinnati in the next few weeks; Horace W. Jenner, of Vincennes, Ind., inventor of the product to be manufactured, is at present looking for a suitable location.

CINCINNATI.—McCaul Co., of Philadelphia, have been awarded the contract to build the new $2,500,000 Hamilton county courthouse; work will be begun at once, and the contract calls for the completion of the building in 30 months.

CINCINNATI.—Bids will be received until April 13 by Samuel Hannaford & Sons, architects, this city, for the construction of the new medical department of Vanderbilt University, Nashville, Tenn; the building will cost about $400,000.

CINCINNATI.—Ferro Concrete Construction Co., this city, has been awarded the general contract for the construction of the new colored branch of the Y. M. C. A., which will cost about $100,000; bids will be received at once for the furnishing materials, including several hundred tons of re-enforcing bars and structural iron and steel.

Dollars and Sense

"More cents; more dollars" is a maxim.

"More sense; more dollars" should be one.

Use these tips and prove the one while vindicating the other.

In addition to inquiring for 300 engine lathes as was reported last week, the Bethlehem Steel Co. is inquiring for a large number of other machines such as turret lathes, automatic screw machines, milling machines and grinders. In addition the company has plans in progress for building an addition to cost about $15,000.

Delaware, Lackawanna & Western railroad is taking bids on a steam hammer, 25-ton gantry crane, lathe, boring mill, a bolt cutter and a shear.

Pikesville Supply & Planing Mill, Pikesville, Ky., will purchase electric motors and wood working machinery for a new plant it is preparing to build.

Phelps, Dodge & Co., 99 John street, New York City, are in the market for six machine tools.

Graf Stove & Range Co., Louisville, Ky., which has been assembling its product for some time, plans to erect a foundry and finishing plant. H. J. Graf is president.

Ferracute Machine Co., Bridgeton, N. J., is figuring on the steel for a 100 x 100-foot addition to its machine shop.

The department of commerce has put out inquiries for seven 5-ton and one 10-ton dock cranes for Portuguese Africa.

Santa Fe railroad, in addition to its inquiry mentioned last week, is asking for a 50-pound hammer and a sensitive drill.

National Tube Co., Pittsburgh, has put out a tentative inquiry for 30 automatic lathes.

Central Iron & Steel Co., Harrisburg, Pa., is in the market for a 150-ton ladle crane.

Pennsylvania railroad is in the market for a 7½-ton crane.

L. F. Shoemaker & Co., Pottstown, Pa., which has closed on some equipment for an extension to its plant, is still in the market for a few cranes.

CLEVELAND.—K. & M. Brass & Aluminum Castings Co. has been incorporated; $10,000 capital stock; by D. E. Morgan, John C. Barkley, L. G. Lomasson, E. Denner, John P. Dempsey.

CLEVELAND.—City council has voted to let a contract for a high pressure duplex feed pump, to be built according to specifications of the head of the municipal lighting division; it will supplement motor and turbine driven centrifugal pumps now in use.

CLEVELAND.—Plans, drawn by the Forest City Steel & Iron Co.'s engineers, for a $22,000, brick and steel mill addition for the Union Rolling Mills Co., 8200 Aetna road, have been submitted to the city building department.

CLEVELAND.—Lake Erie Smelting & Refining Co., 2622 West Fifty-third street, have secured a permit to proceed with the construction of a $15,000 plant addition at 7800 Bessemer avenue; W. J. Watson & Co., architects and engineers, have prepared plans.

CLEVELAND. — Plans for the proposed Woodland avenue substation for the municipal lighting department have been submitteed to the building department; the building will cost $25,000 and will be two stories, with dimensions 54 x 90 feet.

CLEVELAND.—Fisher Brothers, wholesale and retail grocers, will erect a $150,000, 6-story warehouse at Lakeside avenue and East Twenty-second street; it is understood, plans are now being prepared and construction will begin this summer.

CLEVELAND. — Cleveland & Youngstown railroad proposes a plan to unite electric and steam railroads in a joint two-decked union station and freight terminal, to cost several million dollars, on Prospect avenue, between West Third and Ontario streets; Cleveland interests are backing an enabling bill, now before the Ohio legislature, to permit the formation of such a terminal; steam roads which are understood to be prospective members of the terminal project include the Baltimore & Ohio, the Erie, the Wheeling & Lake Erie, the Nickel Plate and the Big Four.

COLUMBIANA, O.—Columbia Tire & Rubber Co. has been incorporated; $300,000 capital stock; by William G., George W., Walter F., and Jacob C. Henne, Jesse E. LaDow and Charles Hoffman.

COLUMBUS, O.—Sanitary Freezer Mfg. Co. has been incorporated, $10,000 capital stock; by J. H. Noon, V. A. Carlson, Josephine Carlson.

COLUMBUS, O. — Chamber of commerce has arranged to bring the Watson Solar Window Co. of Chicago, employing 150 people, to this city; a 4-acre lot has been purchased at Fifth avenue and the Big Four railroad and a $50,000, 75 x 100-foot, 1-story building will be erected within 60 days; company will spend about $50,000 in moving and purchasing new machinery.

HAMILTON, O. — Crites Carburetor Co., recently incorporated at $50,000 to manufacture a carburetor invented by V. C. Crites, Lima, O., probably will erect a plant either in Lima or Hamilton.

HAMILTON, O.—Arthur Morgan, consulting engineer, strongly urges that the proposed Columbia bridge be a 750-foot, two-pier, steel structure; it will cost $12,000 more than the 600-foot, concrete or steel bridge favored by the commissioners.

LORAIN, O.—Pittsburgh & Lake Erie railroad is said to be considering the establishment of terminal yards on several hundred acres of land owned by the company.

NEW BREMEN, O.—Wyen & Grieshop Sheet Metal Mfg. Co. has been incorporated; $6,000 capital stock; by F. H. and Clara Wyen, William Grieshop, J. A. Barhorst.

NEW PHILADELPHIA, O.—Tuscarawas county commissioners have plans on file for bridges and culverts in connection with road

improvements; state highway commissioner will open bids at Columbus April 2.

PIQUA, O.—The Piqua club is raising a bonus to secure a rubber plant which wishes to locate in this city.

PORT CLINTON, O.—American Plaster Co. will substitute electric for steam power in the operation of all machinery, drills, cars, hoists and crushers.

UPPER SANDUSKY, O. — J. Marguerat, county auditor, will open bids April 6 for the construction of the Leslie bridge in Marceilles township; plans are on file with the county surveyor; certified check $100; bids are wanted for two bridges.

WOOSTER, O.—Wooster Shale Brick Co., recently incorporated at $300,000 capital stock, will increase its daily capacity from 40,000 to 60,000 bricks.

CLARKSBURG, W. VA. — Norwood Glass Co. has awarded a contract for the erection of a $75,000 plant to the Pittsburgh & Des Moines Bridge Co., Pittsburgh.

ELM GROVE, W. VA.—It is understood the Cecil Lumber Co., whose planing mill was badly damaged by fire recently, will rebuild.

KANAWHA, W. VA.—Kanawha Lead & Zinc Co. has been incorporated with a capital of $20,000 by J. D. Woodree, E. V. Evans, E. H. Wilford and W. H. Nelson, of Charleston, W. Va.

CLAY, KY.—Clay Light & Ice Co. plans to install an additional boiler and generator, and to build a transmission line to Dixon, Ky.; address C. R. Clark.

GEORGETOWN, KY.—A flour mill will be erected by a $30,000 company which is being organized by Frank Johnson and others.

HODGENVILLE, KY.—Equipment for the local water works, a contract for which was recently let to J. W. and A. Snyder, Taylorville, Ky., includes a 15-horsepower engine, deep-well pump, 50,000-gallon tank, mounted on 75-foot tower, 17,000 feet of water pipe and other supplies.

LEXINGTON, KY.—A. T. Parker is building a steam laundry, for which boilers, engines and transmission equipment, in addition to special machinery, will be needed.

LOUISVILLE, KY.—Norman Lumber Co. is considering enlarging the capacity of its woodworking plant, manufacturing siding and interior finish; A. E. Norman is president.

LOUISVILLE, KY.—Graf Stove & Range Co., which has been assembling its product for some time, plans to erect a foundry and finishing plant; H. J. Graf is president.

LOUISVILLE, KY.—East End Brick Co. has purchased clay lands and will establish a large plant for the manufacture of building brick; address P. M. Crane.

LOUISVILLE, KY.—Sampson Mfg. Engineering Co., Snead building, plans to increase its capitalization and add to the equipment of its factory; it makes automobile starters and other specialties.

MAYSVILLE, KY.—J. S. Everett & Co. are planning the erection of a large grain elevator, for which power and conveying machinery will be needed.

PIKESVILLE, KY.—Pikesville Supply & Planing Mill Co. will purchase electric motors and woodworking equipment for a new plant it is preparing to build.

WHITESBURG, KY.—A stave mill will be equipped by the West Virginia Stave & Lumber Co.; C. W. Hurst is buying the machinery.

BRAZIL, IND.—Brazil Stamping & Mfg. Co. has increased its capital stock $10,000.

ELKHART, IND.—Foster Machine Co. will build two additions to its plant at cost of $3,000.

ELKHART, IND. — County commissioners have recommended the construction of a steel bridge on Elkhart avenue, to cost about $3,250.

MILLTOWN, IND.—Electric Service Co. has been incorporated; $5,000 capital stock; by David S. Cook, Harry Lemmon, Henry S. Gray and others.

NEWCASTLE, IND. — Newcastle Commercial club has closed a deal with the Casket Hardware Mfg. Co., South Bend, Ind., for the removal of its plant to Newcastle; it is planned to have the plant in operation within a couple of weeks.

SHELBYVILLE, IND. — An automobile manufacturing plant which was under the control of the Industrial Club, has been sold for $5,000 to John Morner, who will operate it as a bent wood manufacturing plant in connection with a similar factory at Hamilton, O.

WABASH, IND.—Wabash Cabinet Co. will erect a 1-story addition to its plant on Cass street; T. F. Vaughn is president.

CHICAGO.—Eureka Plowing Co. has been incorporated to manufacture farm implements; $25,000 capital stock; by Charles B. Obermeyer, Herbert S. Simpson and Claire Mendel, 108 South La Salle street.

CHICAGO.—Dahl Iron Works Co., has been incorporated to manufacture structural and ornamental iron and steel; $2,500 capital stock; by Harold P. Dahl, Fred. A. Fischer and Thomas G. Gage, 5726 Montecello avenue.

CHICAGO.—Malloydium Co. has been incorporated to manufacture metals, chemicals and alloys; $100,000 capital stock; by Geo. W. Ray, Lewis Scott Stitts and Alexander M. Rennie, Gary, Ind.

CHICAGO.—Boettcher Pattern Co. has been incorporated to manufacture metal patterns and specialties; $2,500 capital stock; by W. F. J. Boettcher, Ida Boettcher and Arthur Boettcher, 4844 Berteau avenue.

CHICAGO.—Victor Machine Co. has been incorporated to carry on a business of mechanical engineering and experimentation; $5,000 capital stock; by Edmund P. Kelly, N. Hassett and E. F. Herrmann, 209 South La Salle street.

CHICAGO.—Inland Steel Co. has awarded a contract for the erection of a benzol plant to the H. Koppers Co., Pittsburgh; the plant will be equipped to recover benzol from 1,460 tons of coal a day, amounting to about 2,800 gallons of benzol; the plant will be in operation July 1.

BATTLE CREEK, MICH. — City commission has authorized the purchase of two 8-inch pumps with necessary motors and power lines for the Verona pumping station.

DETROIT. — Detroit Foundry Co.'s plant was damaged by fire.

DETROIT.—Standard Motor Parts Co. has been incorporated; $300,000 capital stock; by E. J. Dayton, Oscar Cumbinsky, W. S. Grant.

DETROIT.—Packard Motor Car Co. plans the erection of a 60 x 400-foot building for the storage of assembled parts.

DETROIT.—Ecorse township trustees will provide a $30,000, temporary bridge for the use of the Detroit United railway over the Ecorse river at West Jefferson avenue.

DETROIT.—Twin Seat Valve Mfg. Co. has been incorporated; $5,000 capital stock; by Charles B. Bohn, J. D. Rosenbaum, F. A. Parkhurst.

DETROIT.—Electric Utilities Corporation has received its charter; $50,000 capital stock; by Bethune Duffield, Muir Duffield, John F. Parker.

LAPEER, MICH.—City will vote on a municipal lighting plant and a boulevard lighting system.

CASHTON, WIS.—The garage formerly operated by Felzer & Engbretson at Cashton, Wis., has been leased by John L. Rudolph, Courtney, N. D., who will establish a commercial machine shop in connection.

EAU CLAIRE, WIS.—Phoenix Mfg. Co., sawmill machinery, logging locomotives, tractors, etc., has increased its capital stock from $200,000 to $250,000.

KAUKAUNA, WIS.—Thilmany Pulp & Paper Co. is making plans for a mill and factory, of steel and brick, 72 x 220 feet, two stories, and a concrete warehouse, 40 x 140 feet; the present iron-clad buildings have been purchased by the White-Washburne Toilet Paper Co. for manufacturing purposes.

KEWAUNEE, WIS.—Storle Rotary Valve Engine Co., organized about six months ago by O. O. Storle of Kewaunee, to manufacture a new type of internal combustion engine, adapted especially to automobile and motor truck application, is preparing to undertake a production of engines at once; a small shop is being equipped; later a factory will be erected for permanent occupancy.

LA CROSSE, WIS. — Parkinson & Dockendorff, architects, La Crosse, are completing plans for a $100,000, 4-story, fireproof hospital for the Sisters of St. Francis, to be of brick and stone.

LA CROSSE, WIS.—Wisconsin Pearl Button Co., Dan W. McMillan, president, is making plans for the erection of a $20,000 factory addition, 80 x 125 feet of fireproof construction.

MADISON, WIS.—J. I. Case Threshing Machine Co., Racine, Wis., will build $35,000 branch house at Madison; the building will be 100 x 140 feet, of brick and mill construction, and contain an implement, machinery and automobile warehouse, garage and machine shops; C. M. Doring is branch manager.

MILWAUKEE.—Kurth Co., malsters, is making plans for a grain elevator addition to increase the capacity by 290,000 bushels and providing a total storage capacity of 740,000 bushels.

MILWAUKEE.—E. R. Pahl Mfg. Co., Third and Center streets, baby carriages, go-carts, etc., is having plans prepared for a 25 x 150-foot addition, three stories; C. F. Ringer is architect.

MILWAUKEE.—It is estimated 1,500 to 1,800 tons of structural shapes will be required for the new mercantile building to be erected by the Ticonic Investment Co. on West Water street, north of Grand avenue; plans being executed by H. C. Koch & Son, architects, Wells building, call for a 10-story steel, terra cotta and brick buiding, 80 x 135 feet, to cost about $275,000.

MILWAUKEE.—Theodore Kerner, who has been manufacturing an incinerating system for garbage for residences, apartment houses, hospitals, etc., on a small scale for some time, has organized the Kerner Incinerator Co. with $100,000 capital to engage extensively in the manufacture of the device; with him are associated Frederick L. Sivyer, president, Northwestern Malleable Iron Co. and several other industries, and H. P. Andrae, of Julius Andrae & Son Co.; the company is not ready to divulge its manufacturing plans.

PORTAGE, WIS. — Putzke Air Electric Light & Power Co., organized recently with $20,000 capital and headquarters at Portage, will develop and produce a system for generating electric current by means of wind, in a manner silimar to the ordinary windmill; the system is to be especially adapted to farm use; Mr. Putzke has been elected president; Wm. Grahn, vice president, and Frank Day, treasurer.

RACINE, WIS.—Racine Handy Mfg. Co. has been organized at Racine, Wis., by H. B. Mansfield, C. C. Thronson and B. C. Thronson to manufacture specialties and supplies; the capital stock is $10,000.

RHINELANDER, WIS.—Oneida Boat Co. will erect a small addition to the finishing room; W. E. Cleveland is owner.

RICE LAKE, WIS.—The Red Cedar Valley Electric Co., Rice Lake, has contracted with

the Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo., for an auxiliary generating unit consisting of a 225-horsepower Diesel crude oil engine direct-connected to a 160-kilowatt generator, and a 12,000 gallon oil tank. The equipment will supplement two 160-kilowatt hydroelectric units.

UNION GROVE, WIS.—Price Brothers will erect a factory soon for the manufacture of cement blocks having purchased ground from W. J. Seare.

ST. LOUIS.—A municipal lighting plant, similar to the one in Cleveland, is an issue in St. Louis; the city now is served by the Union Electric Light & Power Co. at 6 and 10 cents.

DUBUQUE, IA.—Two steel bridges will be erected this spring at a cost of about $30,000; W. B. Turley, county engineer, Dubuque.

SOUTHERN STATES

NEWPORT NEWS, VA.—Work on the plant of the International Tool Co., a newly organized concern, will begin shortly.

KINGSTON, N. C.—City will receive bids until April 6 for improvements to the electric light plant including building extensions and new equipment such as generators, boilers, switchboard, engine, condenser, etc.; Gilbert C. White, consulting engineer, Charlotte, N. C.

SPARTANSBURG, S. C.—Suspension Bearing Co. has been commissioned with a capital of $10,000 to engage in the manufacture of machinery bearings and other supplies; Isaac Andrews, president; W. W. Lancaster, secretary.

McGEHEE, ARK.—City will vote May 1 on $65,000 for an electric light and water plant; J. J. Simmons, mayor.

CHATTANOOGA, TENN.—Armour & Co. are reported to be planning the erection of an abattoir.

DRESDEN, TENN.—The city now is taking bids on equipment for a water system and electric light plant; boilers, engines, generators, pumps and accessories are to be purchased; Phil Porter, Clinton, Ky., is engineer.

GERMANTOWN, TENN.—The city is planning to issue bonds for the purpose of building an electric light plant and water system.

HARRIMAN, TENN.—Watts Heading Co. whose mill recently was burned, has announced that work on a new plant will be started at once; J. H. Watts is in charge.

KINGSPORT, TENN.—Clinchfield Portland Cement Co. has increased its capital stock from $1,500,000 to $2,000,000 and greatly will increase its capacity.

MARYVILLE, TENN.—The city plans to sell $55,000 bonds for erecting a water works; R. C. Huston & Co., Memphis, Tenn., are the engineers.

MEMPHIS, TENN.—A. G. Harrison will need a boiler, engine and special equipment for a steam laundry, the building now being under construction.

WAVERLY, TENN.—A. W. Lucas and others are planning to establish a plant for the manufacture of ax-handles, spokes and other turned products.

KINGSTON, OKLA.—City will vote about April 6 on granting franchise to George F. Blenkin, Mansfield, Okla., for electric light system.

WESTERN STATES

McCUNE, KAN.—City clerk will receive bids until April 8 for constructing water works from plans of Henrici, Kent & Black, Kansas City, Mo.

BUTTE, MONT.—W. A. Clark and brother, bankers, will erect a $50,000 concrete and steel building.

LIVINGSTON, MONT.—It is reported a calcium carbide plant is being considered for Jardine, Mont., during the summer; Fred L. Gibson, local attorney is said to be interested.

BELLINGHAM, WASH.—City soon will be in the market for 7,000 feet of 8-inch, 3,000 feet of 4-inch and 2,500 feet of 6-inch iron pipe for laterals.

ELLENSBURG, WASH.—F. M. Carter, city engineer, will prepare plans for an auxiliary steam plant for the lighting department to cost about $60,000; a bond election will be called; J. D. Ross, superintendent of the lighting department at Seattle, is consulting engineer.

SEATTLE.—James Q. Clemmer has announced that himself and associates are planning the construction of a $1,000,000 photo play house.

SEATTLE.—It is reported the Coliseum Co., recently incorporated, plans to construct a $600,000 photo play house; B. Marcus Priteca, Empire building, will be the architect in case the plans go through.

SPOKANE, WASH.—Cunningham Mining & Mfg. Co., Ltd., has been incorporated; $75,000 capital stock; by George A. Cunningham and others.

SPOKANE, WASH.—Work is to start at once on the construction of a glue factory, machine shop, etc., for the Empire packing plant; construction will be under the direction of Peter Corneils, superintendent of construction for the Carstens Packing Co., Tacoma, Wash.; cost will reach about $100,000.

WENATCHEE, WASH.—County engineer will prepare plans for a $35,000 bridge across the Wenatchee.

PORTLAND, ORE. — Joseph Supple has been awarded contract by the government to construct the Steamer Woodland for use of the corps of engineers at $16,978.

WARRENTON, ORE.—It is reported bids are desired by the city water commissioners until April 12 for $150,000 bonds, issued for constructing a water system.

Cuyuna Activities

Brainerd, Minn., March 23.—Drilling on the Great Northern Exploration Co. land in section 3, township 46, range 29, near the Cuyuna-Mille Lacs mine, has uncovered ore in the first and second holes. Hole No. 1 was stopped at 285 feet in ore and hole No. 2, which is 100 feet distant, has entered the ore at 63 feet from the surface.

The Cuyuna-Mille Lacs and Cuyuna-Duluth mines expect to start shipments as soon as navigation opens. The Duluth-Brainerd Iron Co. has negotiations under way for leasing its property at a good figure. The Wilcox mine at Woodrow has shipped 20 cars of ore to date, being the first ore mined and shipped from the range this season. About 60 tons daily are being hoisted.

The Hill Crest pit mine is preparing for development work. A telephone line has been built to the mine property. Two steam shovels are working in the Armour No. 1 pit. The Thompson pit mine is active, one shovel being at work. The Rowe pit mine at Riverton, owned by the Pittsburgh Steel Ore Co., is building a concentrator and preparing for early shipments.

The Croft mine in Crosby is engaged in shaft sinking. The Brainerd-Cuyuna Mining Co. in Brainerd has its shaft down 124 feet. At the proper depth, drifting will be carried on.

John R. Harrington, of Hibbing, expects to soon start drilling on the Holland lands north of the Northern Pacific railway shops. The Iron Mountain Mining Co. mine at Manganese will soon be in shape for shipments. The new boiler house has been completed.

The Armour No. 2 at Crosby and the Kennedy mine at Cuyuna are engaged in hoisting and stockpiling. The Kennedy is the pioneer shipper of the range and is owned by the Rogers, Brown Ore Co.

Work is progressing rapidly on the $4,000,000 plant of the Laclede Gas Light Co., on the river front in Carondelet, near St. Louis. The company took out a permit Friday for three more buildings, which will cost about $20,000. The company expects to begin operations early in the summer.

George Schindler, formerly identified with the Stupkakoff Laboratories, Pittsburgh, has opened a pyrometer testing laboratory in the Highland building, in the East Liberty district, that city.

Will Enlarge Canton Sheet Plant

Stockholders of the Canton Sheet Steel Co., Canton, O., have ratified the proposal of directors to increase the capital stock from $500,000 to $2,000,000, authorizing extensive additions and improvements to the company's plant. The present capacity will be doubled, making a total of 14 hot mills instead of seven. The improvements will be started this spring and completed by fall, it is said. In this connection, W. W. Irwin, president of the company, is quoted as saying:

"We are going to get to it as soon as possible. We have to broaden out because our business has outgrown our present facilities. Our improvements will just double our present output and capacity at the same time doubling our payroll and the number of men employed."

The Canton Sheet Steel Co. started in Canton five years ago with four hot mills and about 200 employes. Directors are W. W. Irwin, C. A. Irwin, James Fraunfelter, Samuel Lowenstein and W. J. Steel. Officers are: President, W. W. Irwin; vice president, H. S. Renkert; secretary and treasurer, C. A. Irwin.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery to July 1.)

Bessemer, valley	$13.60
Bessemer, Pittsburgh	14.55
Basic, Pittsburgh	13.45
Basic, eastern Pa.	14.00
Malleable, Pittsburgh	13.80 to 14.45
Malleable foundry, Chicago	13.00
Malleable foundry, Philadelphia	15.00 to 15.25
Malleable foundry, Buffalo	12.00 to 12.50
No. 1X foundry, Philadelphia	14.54 to 14.79
No. 2 foundry, Pittsburgh	13.80 to 14.45
No. 2 foundry, valley	13.00 to 13.50
No. 2 foundry, Cleveland	13.50
No. 2 foundry, Ironton	12.75 to 13.00
No. 2 foundry, Chicago	13.00
No. 2X foundry, Philadelphia	14.29 to 14.54
No. 2X fdy., N. J. tidewater	13.84 to 14.25
No. 2X foundry, Buffalo	12.00 to 12.50
No. 2 plain, Philadelphia	14.00 to 14.25
No. 2 plain, N. J. tidewater	14.04 to 14.24
No. 2 plain, Buffalo	11.75 to 12.00
No. 2 southern, Birmingham	9.25 to 9.75
No. 2 southern, Cincinnati	12.15 to 12.65
No. 2 southern, Chicago	13.50 to 14.00
No. 2 southern, Phila. delivery	14.00 to 14.50
No. 2 southern, Cleveland	13.25 to 13.75
No. 2 south'n, New York, docks	13.75 to 14.00
No. 2 southern Boston, docks	13.75 to 14.25
No. 2 south'n, interior New Eng.	14.50 to 15.50
No. 2 southern, St. Louis	12.90 to 13.40
Virginia No. 2X furnace	12.50 to 12.75
Virginia 2X, Philadelphia	15.25
Virginia 2X, Jersey City	15.50
Virginia 2X, Boston points	15.75
Gray forge, eastern Pa.	13.25 to 13.50
Gray forge, Pittsburgh	13.45 to 13.70
Gray forge, Birmingham	8.75 to 9.00
Silveries, 8 per cent, Jackson, O.	14.75 to 15.25
Silveries, 5 per cent Birmingham	12.50
Silveries, 5 per cent, Chicago	16.35
Standard low phos., Phil.	19.00 to 20.00
Lebanon low phos., furnace	16.00 to 16.50
Low phos., Pittsburgh	20.95 to 21.20
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	15.75 to 16.50
Charcoal, Buffalo	15.75 to 17.00
Charcoal, Birmingham	25.00

IRON ORE

(Lower lake ports.)

Old range Bessemer, 55 per cent.	$3.75
Mesabi Bessemer, 55 per cent.	3.50
Old range, non-Bess., 51½ per cent.	3.00
Mesabi non-Bessemer, 51½ per cent.	2.85

(Per unit Philadelphia.)

(Prices nominal.)

Foreign Bess., 50 to 65 per cent.	7½c to 8½c
For'n non-Bess., 50 to 65 per cent	7½c to 8½c

COKE

(At the ovens)

Connellsville furnace	$1.50 to 1.65
Connellsville fur. contr.	1.65 to 1.75
Connellsville foundry	2.00 to 2.40
Connellsville fdy., contr.	2.25 to 2.50
Wise county furnace	1.75 to 2.00
Wise county foundry	2.10 to 2.40
Pocahontas furnace	1.75 to 2.00
Pocahontas foundry	2.00 to 2.25
New River, foundry	2.50 to 3.00
New River, furnace	2.00 to 2.25

FERRO-ALLOYS

Ferro-mang., Balti. (prompt)	$90.00 to 100
Ferro-mang. (future), Balti.	78.00
Ferro-silicon, 50 per cent, Pbgh.	71.00 to 73.00
Ferro-silicon, 50 per cent, Phila.	71.00 to 73.00
Ferro-sil., 12 to 13 per cent.	20.00
Ferro-sil., 11 to 12 per cent.	19.00
Ferro-sil., 10 to 11 per cent.	18.00
Ferro-sil., 9 to 10 per cent.	17.00

(Ferro-silicon quoted at furnace Ashland, Jackson and New Straitsville)

Ferro-carbon titanium, carloads, per lb.	8c to 12½c

SEMI-FINISHED STEEL

Open-hearth billets, Phila.	$21.56 to 22.56
Forging billets, Phila.	24.56 to 25.56
Forging billets, Pbgh.	24.00 to 24.50

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.45
From Pittsburgh	.619
From Youngstown	.639
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

Wire rods, Pittsburgh	$25.00 to 26.00
Billets, Pittsburgh	19.50 to 20.50
Billets, Youngstown	18.50 to 19.50
Sheet bars, Pittsburgh	20.00 to 21.00
Sheet bars, Youngstown	20.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh.	1.25c
Stand. open-hearth rails, Pbgh.	1.34c
Lgt. rails, 8-lbs., Pbgh. & Chgo.	1.22c
Lgt. rails, 12 lbs., Pbg. & Chgo.	1.17c
Lgt. rails, 16 to 20 lbs., Pgh. & Chgo.	1.12c
Lgt. rails, 25 to 45 lbs., Pbgh. and Chgo.	1.07c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chicago	21.50 to 22.50
Angle bars, st. sect. Pbgh. base	1.50c
Angle bars, st. sections, Chgo.	1.50c
Spikes, railroad, Pbgh.	1.35c to 1.40c
Spikes, railroad, Chgo.	1.50c
Track bolts, Pbgh.	1.85c
Track bolts, Chgo.	2.00c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	3.00
New England	3.00
Philadelphia	2.79
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.00 to 1.50
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.47
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

SHAPES, PLATES AND BARS

Structural shapes, Pittsburgh	1.15c
Structural shapes, Chicago	1.34c
Structural shapes, Philadelphia	1.259 to 1.309c
Structural shapes, New York	1.269 to 1.319c
Structural shapes, San Francisco	2.00c to 2.05c
Tank plates, Chicago	1.34c
Tank plates, Pittsburgh	1.10c to 1.15c
Tank plates, Philadelphia	1.259c to 1.309c
Tank plates, New York	1.269c to 1.319c
Bars, soft steel, Pittsburgh	1.15c
Bars, soft steel, Chicago	1.34c
Bars, soft steel, Philadelphia	1.259c to 1.309c
Bars, soft steel, New York	1.269c to 1.319c
Hoops, carloads, Pittsburgh	1.25c to 1.30c
Bands, Pittsburgh	1.15c
Shafting, base, Pbgh., standard price list and classification of extras, March 15, 1915	69 to 70 per cent
Bar iron, Chicago	1.12½c to 1.15c
Bar iron, Philadelphia	1.125c to 1.175c
Bar iron, New York	1.125c
Bar iron, Cleveland	1.25c
Bar iron, Pittsburgh	1.10c to 1.15c
Hard steel bars, Chicago	1.20c to 1.25c
Smooth finish, mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	1.80c to 1.90c
No. 28, black, Chicago	1.94c to 1.99c
No. 28, tin mill, black, Pbgh.	1.85c to 1.90c
No. 28, galvanized, Pbgh., nom.	3.40c
No. 28, galvanized, Chgo. (nom.)	3.59c
No. 10, blue, annealed, Pbgh.	1.30c to 1.35c
No. 10, blue, annealed, Phila.	1.459c to 1.509c
Tin plate, 100 lb., coke base nom.	$3.10 to 3.35

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickled, cold roll., and re-anl.	30 cents
Hot roll'd, pickl'd and anl., tin mill	25 cents
Full pickl'd, cold rolled and re-anl.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller levelling	10 cents
Patent levelling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxidizing	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free from mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black.	Galv. Butt-weld.
Steel, ⅜ to 3 inches	80	69½
Iron, ⅜ to 2½ inches	70	59
		Lap-weld.
Steel, 2½ to 6 inches	79	68½

BOILER TUBES

Steel, 3½ to 4½ inches	74
Iron, 3½ to 4½ inches	60

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nails, jobbers, Pittsburgh	$1.60
Plain wire, jobbers, Pittsburgh	1.40
Galvanized wire, jobbers, Pbgh.	1.90
Polished staples, Pbgh.	1.60
Galvanized staples, Pbgh.	2.10
Barb wire, painted, jobbers, Pbgh.	1.60
Barb wire, galv., jobbers, Pbgh.	2.10

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 80 and 15; cut threads 80 and 10; larger or longer, 75 and 15.

Machine bolts with hot pressed nuts ⅜ x 4 inches, smaller or shorter, rolled, 80 and 20; cut, 80 and 15; larger or longer, 80.

Gimlet and cone point lag or coach screws, 85 and 2½.

Hot pressed square, blank or tapped nuts, $6.40 off list; hot pressed hexagon blank or tapped, $7.30 to $7.40 off.

Cold pressed, square, blank or tapped, $6.20 off; hexagon, blank or tapped, ⅝ inch and larger, $7.50; ⅝-inch and smaller, $8.00.

RIVETS

Structural rivets, Pbgh	1.45c to 1.50c
Structural rivets, Chgo	1.68c
Boiler rivets, Pbgh	1.55c to 1.60c
Boiler rivets, Chgo	1.78c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.55c to 1.60c

COLD ROLLED STRIP STEEL

(Subject to regular extras.)

0.10 to 0.19 Carbon.	Base price Cut to length	
1½ inch and wider	Hard.	Soft.
0.100 and thicker	2.85	3.10
0.050 to 0.099 inc.	2.95	3.20
0.035 to 0.049 inc.	3.10	3.35
0.031 to 0.034 inc.	3.35	3.75
0.025 to 0.030 inc.	3.60	4.00
0.020 to 0.024 inc.	3.80	4.20
0.017 to 0.019 inc.	4.70	5.20
0.015 and 0.016	5.10	5.60
0.013 and 0.014	5.95	6.45
0.012	6.55	7.05
0.011	6.90	7.40
0.010	7.25	7.75
	Coils.	
0.100 and thicker	2.75	3.00
0.050 to 0.099 inc.	2.80	3.05
0.035 to 0.049 inc.	2.95	3.20
0.031 to 0.034 inc.	3.10	3.50
0.025 to 0.030 inc.	3.20	3.60
0.020 to 0.024 inc.	3.30	3.70
0.017 to 0.019 inc.	3.60	4.10
0.015 and 0.016	4.00	4.50
0.013 and 0.014	4.70	5.20
0.012	5.05	5.55
0.011	5.40	5.90
0.010	5.75	6.25

CAST IRON WATER PIPE

Six to 48-in., Cleveland	23.75
Four-inch, Chicago	26.00
Six to 12 inches, Chicago	24.00
Large sizes, Chicago	23.00
Six-inch, New York	20.50 to 21.50
Four-inch, New York	21.50 to 22.50
Four-inch, Birmingham	19.50
Six-inch and larger, Birmingham	19.50

Gas pipe, $1 per ton higher than water.

WAREHOUSE PRICES

Steel bars, Chicago	1.65c
Steel bars, Cleveland	1.80c
Steel bars, Cincinnati	1.70c to 1.80c
Steel bars, Philadelphia	1.65c to 1.70c
Steel bars, New York	1.80c
Steel bars, St. Louis	1.70c
Iron bars, Chicago	1.65c
Iron bars, Cleveland	1.75c
Iron bars, St. Louis	1.65c
Iron bars, Cincinnati	1.60c to 1.70c
Iron bars, Philadelphia	1.60c to 1.65c
Iron bars, New York	1.65c to 1.70c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	1.75c
Shapes and plates, Cleveland	1.90c
Shapes and plates, Cincinnati	1.80c to 1.85c
Shapes and plates, St. Louis	1.80c
Shapes and plates, Philadelphia	1.65c to 1.70c
Shapes and plates, New York	1.85c
No. 10 blue anl. sheets, Chgo	1.95c
No. 10 blue anl. sheets, Cleve	2.05c
No. 10 blue anl. sh. St. Louis	2.00c
No. 10 blue anl. sheets, Cinci	1.95c
No. 28 black sheets, Chgo	2.55c
No. 28 black sheets, Cleveland	2.45c
No. 28 black sheets, Cincinnati	2.45c to 2.55c
No. 28 black sheets, St. Louis	2.55c
No. 28 galv. sheets, Chgo	3.75c
No. 28 galv. sheets, Cleveland	3.50c
No. 28 galv. sheets, Cincinnati	3.40c to 3.55c
No. 28 galv. sheets, St. Louis	3.70c

Freight Rates, Coke

From Connellsville regions, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.70
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

No. 1 railroad wrought, Chgo	$ 9.00 to 9.25
No. 1 railroad wrought, Cleve	9.75 to 10.00
No. 1 railroad wrought, St. L	8.50 to 9.00
No. 1 railroad wrought, Cincin	8.00 to 8.50
No. 2 railroad wrought, Chgo	8.50 to 9.00
No. 2 railroad wrought, St. L	8.25 to 8.50
Arch bars and transoms, Chgo	12.25 to 12.50
Arch bars and transoms, St. L	11.00 to 11.50
Knuckles, coup. & spr'gs, Chgo	8.75 to 9.00
Knuckles, coup. & spr'gs, St. L	8.50 to 9.25
Shafting, Chicago	11.75 to 12.25
Shafting, St. Louis	11.00 to 11.50
Steel car axles, Chicago	11.25 to 11.75
Steel car axles, St. Louis	10.00 to 10.50
Locomotive tires, Chicago	9.00 to 9.50
Locomotive tires, St. Louis	9.25 to 9.75
Cut forge, Chicago	8.50 to 9.00
Pipes and flues, Chicago	7.00 to 7.25
Pipes and flues, Cleveland	7.25 to 7.50

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—	
New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, (all rail)	80 cents
Pacific coast, via Panama canal	61.9 cents

Pipes and flues, St. Louis	6.50 to 7.00
No. 1 cast, Chicago	9.00 to 9.25
No. 1 cast, Cleveland	10.00 to 10.50
No. 1 cast, Cincinnati	8.50 to 9.00
No. 1 cast, St. Louis	9.00 to 9.25
No. 1 busheling, Chicago	7.75 to 8.00
No. 1 busheling, Cleveland	8.25 to 8.50
No. 1 busheling, Cincinnati	6.00 to 6.50
No. 1 busheling, St. Louis	7.50 to 7.75
No. 2 busheling, Chicago	6.75 to 7.00
No. 1 boiler plate, cut, Chgo	5.50 to 5.75
No. 1 boiler plate, cut, St. L	5.50 to 5.75
Boiler punchings, Chicago	8.25 to 8.75
Cast borings, Chicago	5.00 to 5.25
Cast borings, Cleveland	6.00 to 6.25
Cast borings, Cincinnati	4.75 to 5.25
Cast borings, St. Louis	5.00 to 5.50
Machine shop turnings, Chicago	5.25 to 5.75
Machine shop turnings, Cleve	5.75 to 6.00
Machine shop turnings, Cinci	$ 4.75 to 5.25
Machine shop turnings, St. L	5.50 to 6.00
Malleable agl., Chicago	7.50 to 7.75
Malleable agricultural, St. Louis	6.50 to 7.00
Malleable, railroad, Chicago	7.75 to 8.25
Malleable, railroad, Cincinnati	7.00
Malleable, railroad, St. Louis	7.00 to 7.50
Angle bars, iron, Chicago	11.75 to 12.25
Angle bars, iron, St. Louis	10.00 to 10.50
Angle bars, steel, Chgo	8.25 to 8.50
Angle bars, steel, St. Louis	8.00 to 8.25
Stove plate, Chicago	8.25 to 8.50
Stove plate, Cleveland	8.00 to 8.50
Stove plate, Buffalo	8.25 to 8.75
Stove plate, Cincinnati	6.50 to 7.00
Stove plate, St. Louis	7.25 to 7.50
Bundled sheet, Cincinnati	4.75 to 5.25

(Gross tons.)

Heavy melting steel, Pbgh	$12.00 to 12.50
Heavy melting steel, Buffalo	10.25 to 10.75
Heavy melting steel, Chgo	9.75 to 10.25
Heavy melting steel, Cleveland	10.25 to 10.50
Heavy melting steel, Cincinnati	9.00 to 9.50
Heavy melting steel, eastern Pa.	11.00 to 11.50
Heavy melting steel, New York	9.00 to 9.25
Heavy melting steel, St. Louis	9.50 to 10.00
Bundled sheet, Buffalo	7.00 to 7.50
Grate bars, Buffalo	9.00 to 9.50
Grate bars, New York	6.50 to 7.00
No. 1 railroad wrought, east. Pa.	12.50 to 13.00
No. 1 railroad wrought, Pbgh	10.25 to 10.75
No. 1 R. R. wght., New York	9.50 to 10.00
No. 1 R. R. wrought, Buffalo	10.00 to 10.50
Shafting, New York	12.00 to 12.50
Shafting, eastern Pa.	14.50 to 15.00
Wrought pipe, New York	8.00 to 8.25
Wrought pipe, eastern Pa.	10.25 to 10.50
Mch. shop turnings, New York	5.75 to 6.25
Machine shop turnings, Buffalo	5.50 to 6.00
Mch. shop turnings, Pbgh	7.75 to 8.00
Mch. shop turnings, eastern Pa.	8.25 to 8.75
Cast borings, New York	5.75 to 6.25
Cast borings, eastern Pa.	8.00 to 8.50
Cast borings, Buffalo	6.00 to 6.50
Cast borings, Pittsburgh	8.25 to 8.50
Stove plate, N. J. points	8.50 to 8.75
Stove plate, Pittsburgh	8.25 to 8.75
Stove plate, eastern Pa.	9.00 to 9.50
Shoveling steel, Chicago	9.00 to 9.50
Shoveling steel, St. Louis	8.00 to 8.50
Reroll'g rails, 5 ft. & ov., Pbgh.	12.50
Reroll. rails, 5 ft. & ov., Chgo	10.00 to 10.50
Reroll. rails, 5 ft. & ov., Cleve	11.00 to 11.50
Reroll. rails, 5 ft. & ov., E. Pa.	11.50 to 12.00
Reroll. rails, 5 ft. & ov., St. L.	10.00 to 10.50
Steel rails, short, St. Louis	9.50 to 9.75
Steel rails, short, Chicago	10.25 to 10.50
Steel rails, short, Cleveland	11.00 to 11.50
Steel rails, short, St. Louis	9.50 to 9.75
Iron rails, Cleveland nom.	11.75 to 12.00
Iron rails, Chgo	12.00 to 12.25
Iron rails, Cincinnati	10.25 to 10.75
Iron rails, eastern Pa.	13.50 to 14.00
Iron rails, St. Louis	10.00 to 10.50
Iron rails, Pittsburgh	13.00 to 13.50
Frogs, switches, guards, Chgo	9.25 to 9.50
Frogs, switches & g'rds, St. L.	9.25 to 9.50
Car wheels, (iron), Pittsburgh	10.50 to 11.00
Car wheels, (steel), Pittsburgh	11.50 to 12.00
Car wheels, Chicago	10.00 to 10.50
Car wheels, eastern Pa.	10.75 to 11.25
Car wheels, Buffalo	10.00 to 10.50
Car wheels, N. J. points	9.25 to 9.50
Car wheels, St. Louis	10.50 to 11.00
Iron axles, Pittsburgh	18.00 to 18.50
Iron axles, Cincinnati	19.00 to 20.00
Iron axles, eastern Pa.	18.50 to 19.00
Iron axles, Buffalo	16.00 to 16.50
Iron axles, Chicago	15.25 to 15.75
Steel car axles, New York	11.50 to 12.00
Steel car axles, Buffalo	12.00 to 12.50
Steel car axles, Cleveland	12.00 to 12.50
Steel car axles, eastern Pa.	14.00 to 14.50
No. 1 busheling, Buffalo	7.50 to 8.00
No. 1 busheling, Pittsburgh	9.75 to 10.00
No. 2 busheling, Buffalo	5.25 to 5.75
Low phosphorus steel, Buffalo	12.50 to 13.00
Low phosphorus steel, Pbgh	13.25 to 13.75
Low phos. steel, eastern Pa.	14.00 to 14.50
No. 1 forge, eastern Pa.	8.00 to 8.50
No. 1 cast, eastern Pa.	12.00 to 12.50
No. 1 cast, Pittsburgh	12.00 to 12.25
No. 1 heavy cast N. J. points	11.00 to 11.50
Mall. iron, R. R., Cleveland	10.25 to 10.50
Malleable railroad, Pittsburgh	10.00 to 10.25
Malleable R. R., Buffalo	9.50 to 10.00
Malleable, R. R., east Pa.	8.50 to 9.00
Bundled sheet, Pittsburgh	9.25 to 9.50
Bundled sheet, Cleveland (nom.)	7.75 to 8.25

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Ohio Wood Preserving Co.
Michigan Wood Preserving Co.

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Plants: Pittsburgh, Pa. Orrville, Ohio Reed City, Mich.

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CLEVELAND ELECTRIC MOTOR CO.

5518 Euclid Avenue Cleveland, O.

How an Axle Failed in Service

(*Continued from page* 610)

having substantially the same diameter as the wheel fit, which feature directs attention to the hub of the wheel as a probable object responsible for the circumferential scoring.

Upon dismantling the axle further evidence was disclosed which directed attention to this part of the wheel fit, namely, the serrations on the cylindrical surface, previously referred to, which were located near the place of rupture. Efforts were directed toward ascertaining why these serrations were present, which apparently attached to the period of machining the rough-turned forging or when pressing on the wheels. The rough-turned axles were finished in lathes which were located in the immediate vicinity of the hydraulic press used for pressing on the wheels. That such marks could have been present on the finished surface of the axle and not attract the attention of the lathe operator is improbable, while their character is unlike what might be expected to occur in the lathe. There appeared no reasonable opportunity for the axle to receive the serrations in transit from the lathe to the press.

Conjecturally the most probable explanation for the cause of their presence attaches to the time when the wheels were pressed on the axle. If, by accident, the axle was started askew when it first entered the hub of the wheel, the rapid action of the pump of the hydraulic press might cause damage to the wheel fit before its operation could be arrested. Provided this happened, the presence of the sharp circumferential scoring would be consistently accounted for. Furthermore, the removal of the axle or its readjustment normal to the face of the hub would require unusual efforts, and hammering the axle to release it for readjustment is a plausible affair. The choice of tools available to do this is not very great in the vicinity of a wheel press, and such serrations might result from the use of some chance tool found near by.

Serious Effect of Circumferential Scoring

The cause of the failure of the axle appears associated with the presence of the circumferential scoring which was on the surface of the wheel fit, and that its endurance in service was impaired by this groove. An illustration bearing on the behavior of this axle was furnished by duplicate test shafts recently submitted to repeated alternate stresses, similar in kind to the stresses which ruptured this axle. One of the shafts was accidentally scored during the test by a loose set screw. The place of rupture was located by this scoring, and the number of repetitions of stresses was reduced 664,700 times, apparently by reason of this surface defect. The total number of repetitions of loads sustained by the injured and uninjured shafts were 262,000 and 926,700, respectively. Sharp re-entering angles and sudden changes in cross-section are recognized as undesirable in material subjected to repeated alternate stresses. Slight surface defects are also detrimental, increasing in gravity with the magnitude of the stresses and with the use of higher or harder grades of steel.

It is problematical how long axles endure in service after rupture actually begins. Annular fractures are at times formed and are probably of slower development than fractures which develop on one side of the axle only.

In conclusion, it appears that the derailment of train No. 3 was due to the fracture of a tender axle; that the type of failure was a progressive or detailed fracture, starting from one side of the axle and thence extending inward; that final rupture occurred when there remained

intact only about one-quarter of the original cross-section of metal; that the fracture of the axle occurred on the wheel fit, at a place some 3/16 to 7/16 inch within the section covered by the hub of the wheel; that the location of the place of rupture was probably influenced by circumferential scoring on the surface of the wheel fit, which the plane of rupture followed over a part of its course, and that the scoring was a defect of workmanship incident to the period of finishing the axle or when the wheel was being pressed on the end which subsequently fractured.

The investigation showed that steel of good quality was used in the axle, the immediate cause of failure appearing to be the presence of a surface defect on the wheel fit, which place marked the location of rupture. The fracture of an axle of this size is a very disquieting matter, provided no unusual and specific cause is discovered. The influence which surface defects have in limiting the endurance of shafts and axles is well known, and the presence of such a defect on this axle is in a way reassuring, since it removes a doubt which would attach to all axles of this class if no local defect led to its failure.

The customary inspection in this instance did not guard against defects of workmanship, nor in the case of this axle did it afford assurance that the material inspected by representatives of the Baltimore & Ohio railroad would be used to the exclusion of other material not inspected by them. However, the inspection of the material in the present case had only an indirect bearing; a more vital feature pertained to the workmanship and assembling of the wheels on the axle.

Behavior of Steel Coaches

The behavior of steel cars is brought into prominence in this accident. In several of its annual reports to congress the interstate commerce commission has called particular attention to the desirability of all cars used in high-speed passenger train service being constructed of steel, and in connection with many serious accidents investigated attention has been called to the damage sustained by cars of wooden construction as compared with cars of steel construction.

The accident under investigation affords another exceptionally interesting opportunity for a study of the behavior of the all-steel passenger car in a serious derailment. The train involved was running on straight track at the rate of 57 miles per hour. Although the impact of the heavy all-steel sleeping car Rachita against the end of a modern steel bridge, while moving at high speed, damaged the bridge to such an extent that it collapsed, throwing the sleeping car to the track below, a distance of 20 or 25 feet, yet the car was not seriously damaged, and none of its occupants were killed or seriously injured.

The United States is by far the largest copper producer in the world; in fact, it produces more than all the rest of the world together. The growth of the copper industry in the United States has been notable, according to figures compiled by the United States geological survey. In 1845 the production was 224,000 pounds; in 1913 it was 1,224,484,098 pounds. The total production of the United States from 1850 to 1913 was 18,857,476,910 pounds.

The Commonwealth Fellowship Club of the Commonwealth Steel Co., Granite City, Ill., has published the first volume of a booklet called "The Commonwealther". The book is issued for the benefit of the employes of the Commonwealth company. The first number contains interesting stories and photos devoted to a variety of subjects of interest to the employes.

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